AGRICULTURAL EXPERIMENT STATION

KANSAS STATE AGRICULTURAL COLLEGE
MANHATTAN, KANSAS

DEPARTMENT OF CHEMISTRY

FERTILIZER CONTROL in 1921

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EXPLANATORY STATEMENTS

In compliance with the Kansas fertilizer law, samples of the different brands of fertilizer sold in the state are each year collected and analyzed. The analytical report on the samples collected during the year 1921 is presented in Table I.

During the year 27 towns were vlslted, 31 dealers called upon, and 66 samples, representing 37 brands, collected.

The figures in Table I are given in terms of elements, not compounds. This is in accordance with the Kansas fertilizer law. The figures for compounds are larger than the corresponding figures for elements Thus 12 percent of phosphoric acid is equivalent to 6.24 percent of phosphorus, 2 percent of potash is equivalent to 1.66 percent potassium, 2 percent of ammonia is equivalent to 1.66 percent of nitrogen. The relation between the elements and the compounds can be seen from the following rules for converting any one form into terms of its corresponding form.

Percent nitrogen X 122 = percent ammonia
Percent ammonia X 082 = percent nitrogen
Percent phosphorus X 229 = percent phosphoric acid
Percent phosphoric acid X 0487 = percent phosphorus
Percent potasslumX12= percent potash
Percent potash X 083 = percent potassium

The value of a fertilizer[18] not influenced by the method used in stating results. The value of a fertilizer depends on (1) the amount and kind of plant food elements present, (2) the form of combination or availability of these elements, and (3) the physical texture or ease with which the fertilizer may be handled and applied to the soil. The value of a fertilizer does not depend on a brand name. Different brands having the same formula are equally valuable if the chemical combination of the elements and the physical condition are the same. The elements of value in commercial fertilizers are (1) nitrogen (2) phosphorus, and (3) potassium.

Nitrogen — The Kansas fertilizer law requires the manufacturers to register and guarantee total nitrogen only. If the inspection report shows that the total nitrogen present is equal to the guaranty, the manufacturer has compiled with the letter of the law, provided that some of this nitrogen does not come from horns, hoofs, hair leather scrap, or similarly inert material. Some of this inert material may be treated with compressed steam or sulphuric acid so as to completely change the character of the original material and make the nitrogen available for plant use.

Nitrogen which comes from material soluble in water is available immediately for plant use. Such nitrogen usually comes from such mineral salts as sodium nitrate and ammonium sulphate. Nitrogen which comes from slaughterhouse products is quickly made available for plant use by the conditions existing in the soil. Most of the nitrogen found in fertilizers sold in Kansas comes from these two sources.

It is a simple matter to determine the amount of water-soluble nitrogen present in a fertilizer. To distinguish between the available water-insoluble and the unavailable water-insoluble is not so simple. Not all nitrogen from slaughterhouse products or from by-products of seeds is equally available. There is a difference between the availability of nitrogen in steamed bone and in dried blood Some of the nitrogen from steamed bone is as available as the nitrogen from dried blood and some is not. There are chemical methods for distinguishing between these forms. While these chemical methods have not recieved the same degree of endorsement by fertilizer chemists as the method for totals of the elements, the results obtained do have a value.

Phosphorus — Phosphorus is given under three headings in Table I Phosphorus in phosphates (1) Available or reverted, (2) insoluble, and (3) total. Most companies do not make a separate guaranty for the water-soluble and available or reverted, but in-

clude both under the latter heading as presented in Table I. This is just as satisfactory, as the two forms have practically the same agricultural value. In the ordinary mixed fertilizer the amount of phosphorus found in insoluble phosphate is small. This is because ordinarily acid phosphate is the source of phosphorus. This insoluble form of acid phosphate has a low value, both commercially and agriculturally, in comparison with the available. The insoluble has the same value as the phosphorus from rock phosphate. In bone goods the conditions are different. From one-third to two-thirds of the phosphorus from bone is in the insoluble form. But this becomes available for plant use much more quickly than the insoluble from the acid phosphate. It is usually best to consider only total phosphorus in bone goods.

It is undesirable to mix bone goods with acid phosphate. Bone goods have an established value, known and understood by farmers. So has acid phosphate. When acid phosphate is mixed with bone goods there is no satisfactory way to distinguish between the insoluble from bone and the insoluble from acid phosphate, and the analytical report on such fertilizers shows them to a disadvantage in comparison with fertilizers whose phosphorus comes wholly from acid phosphate

Potassium. — The only form of potassium recognized by the state law is that soluble in water. The original source of potassium makes no difference provided the carrier of the compound containing potassium does not contain any deletenous substances. The source of most potassium found in fertilizers is potassium sulphate and potassium chloride, sometimes called muriate of potash.

ANALYSES OF INSPECTION SAMPLES

In the results of the analyses of inspection samples of fertilizers given in Table I, those which fall below the guaranteed analysis more than one-fifteenth are given in bold-face type. These are deficient according to the state law. The results may be summarized as follows:

	Total Analyses	Number Deficient	Percent Deficient
Total nitrogen	37	4	10.8
Phosphorus in available form	30	3	10.0
Total phosphorus	48	0	0.0
Water-soluble potassium	17	2	11.8

The results of this summary are nearly the same as those of 1920 An examination of Table I will show that many more samples were more than one-fifteenth above the guaranty than were more than one-fifteenth below the guaranty.

TABLE I.—RESULTS OF ANALYSES OF INSPECTION SAMPLES OF FERTILIZERS, 1921

MANUFACTURER, BRAND ON SALE, AND DEALER	Composition guaranteed (G) and found (F)	Percent nitrogen	Percent phosphorus in phosphates			Percent potassium soluble in water	Maximum percent of chlorin
			Available or reverted	Insoluble	Total		
American Agricultural Chemical Company (Empire Carbon Works)							
"EMPIRE FARMER'S FAVORITE 1–10–1	G	0.82	4.37	0.22	4.59	0.83	1.00
873 A. R. Nash, Farm Agent, Faulkner	F	1.16	5.31	.74	6.05	1.37	3.30
878 Dearing Produce Company, Dearing	F	1.13	5.39	.77	6.16	1.12	4.08
881 Farmer's Supply & Exchange Company, Independence	F	1.03	5.43	.85	6.28	1.04	2.96
891 Galesburg Grain Company, Galesburg	F	1.09	5.69	.66	6.35	1.14	1.21
EMPIRE 16 PERCENT ACID PHOSPHATE	G	.....	6.99	.22	7.21	.....	.....
879 Dearing Produce Company, Dearing	F	.....	8.30	.68	8.98	.....	.....
890 Galesburg Grain Company, Galesburg	F	.....	8.40	.62	9.02	.....	.....
EMPIRE BONE MEAL	G	1.65	.....	.....	11.80	.....	.....
880 Farmer's Supply & Exchange Company, Independence	F	(a) 1.27	.....	.....	14.40	.....	.....
EMPIRE NITROPHOS	G	1.65	5.24	.22	5.46	.....	.....
893 W. B. Young & Co., Chanute	F	1.85	6.81	.73	7.54	.....	.....
Arkansas Fertilizer Company							
WHITE DIAMOND BRAND SPECIAL ACID PHOSPHATE	G	.....	6.99	.87	7.86	.....	.....
859 H. W. Sutton, Weir	F	.....	8.64	.14	8.78	.....	.....
Armour & Co.							
ARMOUR'S HELMET BRAND 16 PERCENT PHOSPHATE	G	.....	6.99	.22	7.21	.....	.25
863 Gable & Kelso, Weir	F	.....	7.93	.21	8.14	.....	.....
889 Farmer's Union Co-op. Assn., Galesburg	F	.....	8.36	.33	8.69	.....	.....
BIG CROP BONE MEAL	G	2.46	.....	.....	10.50	.....	.25
864 Gable & Kelso, Weir	F	2.45	.....	.....	11.52	.....	.....
875 J. M. Forbes, Hallowell	F	2.51	.....	.....	11.80	.....	.....
ARMOUR'S BIG CROP 2–12–2	G	1.65	5.24	.22	5.46	1.66	2.00
884 Boman Milling Company, Independence	F	1.79	6.57	.72	7.29	1.84	1.84
ARMOUR'S BIG CROP 1–12–1 FERTILIZER	G	.82	5.24	.22	5.46	.83	1.00
885 Boman Milling Company, Independence	F	1.07	5.49	1.72	7.21	.90	.64

BIG CROP 1½ BONE MEAL ½ ACID PHOSPHATE	G	1.23	4.80	3.93	8.73		.25
900 Crawford County Farmer's Co-op. Assn., Girard	F	1.24	4.34	5 46	9.80		
Cochrane Packing Company							
COCHRANE'S CHAMPION GRAIN GROWER	G	1.65	4.73	.22	4 59	.83	
899 A. F. LaForge, Girard	F	1.29	3.56	1.36	4 92	.68	.28
Cudahy Packing Company							
CUDAHY'S BLUE RIBBON STEAMED BONE MEAL	G	2.47			10.48		
858 Kelso Grain Company, Pittsburg	F	3.03			11.32		
874 P. B. White, Faulkner	F	2.87			12.01		
886 Farmer's Union Co-op. Assn., Dennis	F	2.99			12.02		
888 Farmer's Union Co-op. Assn., Parsons	F	2.90			11.91		
BLUE RIBBON FERTILIZER HALF & HALF 1½–20	G	1.50	5.24	3.49	8 73		
904 Farmer's Union Elevator Company, Burlington	F	2.92	4.87	6.23	11.10		
Earp-Thomas Cultures Corporation							
STIM-U-PLANT	G	11.00	5.00	.20	5.20	12.40	1.60
907 Zimmerman Seed Company, Ottawa	F	11.57			5.72	12.92	
Interstate Fertilizer Company							
INTERSTATE BONE & SHEEP MANURE 2–14–2	G	1.65	2.04	4.08	6.11	1.66	1.00
902 S. W. Farm Club, Opolis	F	1.91	1.69	4.60	6.29	4.38	4.11
Morris & Co.							
STEAMED BONE MEAL	G	.82			13.97		
866 E. B. Davis, Columbus	F	1.11			14.65		
Swift & Co.							
1¼–30–0 BONE MEAL FERTILIZER	G	1.03			13.11		
857 Pittsburg Elevator Company, Pittsburg	F	1.26			15.55		
871 Baxter Bottle Works, Baxter Springs	F	1.47			13.77		
876 J. M. Forbes, Hallowell	F	1.71			13.90		
DIAMOND "K" GRAIN GROWER 1–12–1	G	.82	5.24	.22	5.46	.83	1.50
872 Baxter Bottle Works, Baxter Springs	F	.94	5.73	.55	6.28	1.54	.25
DIAMOND "A" VEGETABLE & FRUIT GROWER 3–8–3	G	2.47	3.49	.44	3.93	2.49	1.50
882 Union Implement Company, Independence	F	1.47	5.75	.68	6.43	.49	.25
DIAMOND "L" GRAIN GROWER 2–12–2	G	1.65	5.24	.22	5.46	.83	1.28
883 Union Implement Company, Independence	F	1.67	6.68	.69	7.37	.95	.32
SWIFT'S CHAMPION WHEAT & CORN GROWER	G	1.65	5.24	.22	5.46	1.66	1.88
905 Gifford & Harden, Burlington	F	1.50	5.62	1.07	6.69	2.05	.60
SWIFT'S HIGH GRADE ACID PHOSPHATE FERTILIZER	G		6.99	.22	7.21		
895 Uniontown Grain Company, Uniontown	F		8.65	.15	8.80		
903 Otto Link, Piqua	F		7.85	.46	8.31		
SWIFT'S BONE MEAL & PHOSPHATE	G	.82			8.04		
906 Gifford & Harden, Burlington	F	2.64			7.69		

TABLE I.—CONCLUDED

MANUFACTURER, BRAND ON SALE, AND DEALER	Composition guaranteed (G) and found (F)	Percent nitrogen	Percent phosphorus in phosphates			Percent potassium soluble in water	Maximum percent of chlorin
			Available or reverted	Insoluble	Total		
The Pulverized Manure Company							
WIZARD BRAND PHOSPHATED MANURE	G	.82	3.79	.....	3.79	1.00	.....
867 E. B. Davis, Columbus	F	1.34	4.99	.34	5.33	1.62	.68
892 Farmer's Union Co-op. Assn., Galesburg	F	1.22	5.02	.18	5.20	1.47	.61
Tupelo Fertilizer Factory							
TUPELO WHEAT BELT	G	1.65	5.24	.23	5.47	1.66	1.50
860 Weir Farmer's Union, Weir	F	2.46	6.11	1.03	7.14	2.29	6.46
TUPELO 3 & 24 STEAMED BONE MEAL	G	2.47	.....	.....	10.48	.....	.....
861 Weir Farmer's Union, Weir	F	2.40	.....	.....	10.18	.....	.....
901 Geo. Dean, Opolis	F	3.18	.....	.....	11.72	.....	.....
TUPELO HIGH GRADE 16 PERCENT ACID PHOSPHATE	G	.....	6.99	.43	7.42	.....	.....
865 Weir Farmer's Union, Weir	F	.....	8.65	.73	9.38	.....	.....
Virginia-Carolina Chemical Company							
V. C. SUPERPHOSPHATE	G	.....	7.09	.42	7.52	.....	.....
862 H. W. Sutton, Weir	F	.....	8.35	.27	8.62	.....	.....
V. C 18 PERCENT SUPERPHOSPHATE	G	.....	7.92	.43	8.35	.....	.....
896 John D. Miller, Girard	F	.....	9.31	.18	9.49	.....	.....
V. C. STEAMED BONE MEAL	G	2.50	.....	.....	9.61	.....	.....
897 John D. Miller, Girard	F	2.95	.....	.....	9 50	.....	.....
MONARCH GRAIN GROWER	G	.....	6.55	.95	7.50	1.66	70
898 John D. Miller, Girard	F	.....	8.18	.77	8.95	1.68	1.03
Wilson & Co.							
WILSON'S SPECIAL BONE MEAL	G	.82	.....	.....	13.00	.....	.....
868 Cherokee County Mill & Elevator Company	F	1.73	.....	.....	13.94	.....	.....
887 Farmer's Union Co-op. Assn., Parsons	F	.81	.....	.....	13.37	.....	.....
WILSON'S BONE MEAL & ACID PHOSPHATE	G	.82	6.25	3.75	10.00	.....	.....
869 Cherokee County Mill & Elevator Company, Columbus	F	.99	5.49	4.80	10.29	.....	.....

(a) Results falling below the guaranteed analysis more than one-fifteenth are given in bold-face type. These are deficient, according to the state law.

SALE OF FERTILIZERS IN KANSAS

The amount of fertilizers sold in the state can be calculated in two ways (1) Reports from manufacturers, and (2) sales of tax tags The Kansas fertilizer law does not mention the 125-pound bag, but requires a tag to be placed on each package of 200 pounds or fraction thereof The common practice, however, is to sell fertilizers in 125-pound bags This fact has been taken into consideration in computing the figures given below showing the sales of fertilizers in Kansas for the last five years It has been assumed that since 1917, 125 pounds represents the average bag The total number of tons of fertilizer sold during each of the last five years calculated by each method is as follows

	Tons Sold	
Year	Figures from sale of tax tags	Figures from manufacturers' reports
1917	8,063	6,870
1918	10,585	10,600
1919	16,937	12,412
1920	15,200	12,652
1921	5,280	4,049

A study of the tabulation will show either that a large amount of fertilizer was sold in less than 125-pound bags during the years 1919, 1920, and 1921, or that, what is more probable, the manufacturers anticipated a much larger sale during those years than actually took place

CLASSES OF FERTILIZERS

Fertilizers may be divided into three classes Bone goods, acid phosphate, and mixed goods For the last five years the distribution of Kansas sales among these classes has been as follows

Year	Bone Goods	Acid Phosphate	Mixed Goods
1917	2,975 tons	486 tons	3,407 tons
1918	3,997 tons	533 tons	6,068 tons
1919	4,127 tons	1,388 tons	6,897 tons
1920	2,855 tons	2,506 tons	7,291 tons
1921	2,062 tons	945 tons	1,042 tons

The figures for 1921 show a large decrease in the sale of mixed goods and acid phosphate, but only a moderate decrease in bone goods sold

FORMULAS OF FERTILIZERS SOLD

As a rule fertilizer formulas indicate the percents of ammonia, phosphoric acid, and potash, respectively, found in a given ferti-

lizer The formula of each brand of fertilizer of which more than 100 tons were sold in 1921 is given in the following table·

Formula	Tons Sold
1-9-1	190
1-10-1	148
1-12-1	289
2-12-2	119
1-30-0	293
1¼-30-0	682
2-27-0	289
3-24-0	766
0-16-0	820
Total	3,596

That phosphorus is the leading element in fertilizers is shown not only by the preceding formulas but also by the amount of each element sold The brands of fertilizers sold in Kansas represent 54 formulas The tabulation giving the formulas of brands of which not less than 100 tons were sold in Kansas in 1921, shows that there is very little demand for more than one-third of these formulas Bone and acid phosphate represent about 75 percent of all the fertilizers sold in Kansas in 1921

DISTRIBUTION OF SALES

Most of the fertilizers sold in Kansas are used in the southeastern part of the state, more than one-half of the total sales being in the four southeastern counties—Cherokee, Crawford, Labette, and Neosho About one-fourth was sold in Cherokee county alone

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PRICES OF COMMERCIAL FERTILIZERS

Farmers will continue to buy commercial fertilizers if their use is profitable The value of the increase in the crop produced must be more than sufficient to pay for the cost of the fertilizer and the labor involved in its use This means a certain correlation between the cost of the fertilizer and the selling price of farm products During the last year there has been a very noticeable decline in the sale price of fertilizers At the same time there was a decline in the price of farm products

COMPARISON OF DEALERS' PRICES, 1921

At the time of inspecting fertilizers, prices are obtained from local dealers These prices are found in Table II The fertilizers are distinguished by their formulas (See page 10) Many dealers, manufacturers, and brands are omitted Of the classes of fertilizers,

mixed goods contains all three or at least two of the elements of plant food, bone meal contains nitrogen (N) and phosphorus (P), and acid phosphate contains phosphorus only. Most brands of acid phosphate have the formula 0-16-0 though brands havlng the formulas 0-18-0 and 0-20-0 areregistered. An acid phosphate having the formula 0-18-0 carries 12½ percent more plant food, and one havlng the formula 0-20-0 carries 25 percent more plant food than one havlng the formula 0-16-0. This should be considered when comparing prices.

There is a difference in availability of phosphorus in bone meal and in acid phosphate. In the latter only that immediately available is figured in the guaranty and in fixing prices. The phosphorus in bone meal is somewhat more slowly available than phosphorus in acid phosphate, but most of it becomes available during the first season and the rest will be available for following crops. This should also be considered in comparing prices. Mixed goods containing nitrogen and phosphorus only furnishes the same elements as bone meal. Such fertilizers are often made up of mixtures of bone meal and acid phosphate.

TABLE II —DEALERS' PRICES ON COMMERCIAL FERTILIZERS, 1921

DESCRIPTION OF FERTILIZER	Formula	Price per ton	Units of plant food per ton (a)		
			Nitrogen	Phosphorus	Potassium
Mixed Goods, N P K	1-9-1	$30 00	0 82	3 79	0 83
" " "	1-10-1	Min 29 25 Max 35 00 Ave 31 16	82	4 37	83
" " "	1-12-1	33 00	82	5 24	83
" " "	2-12-2	Min 28 75 Max 37 50 Ave 33 41	1 65	5 24	1 66
" " "	2-14-22	35 40	1 65	6 11	1 66
Mixed Goods, N P	1-12-0	33 00	82	5 24	00
" " "	1-20-0	33 50	82	8 74	00
" " "	1-28-0	32 00	82	6 25	00
" " "	1½-20-0	Min 29 10 Max 32 50 Ave 30 80	1 28	8 73	00
Bone Meal	1-30-0	Min 32 50 Max 35 00 Ave 33 33	82	13 11	00
" "	1½-30-0	Min 32 50 Max 41 00 Ave 35 33	1 03	13 11	00
" "	3-24-0	Min 32 00 Max 35 00 Ave 32 58	2 47	10 48	00
Acid Phosphate	0-16-0	Min 22 50 Max 30 00 Ave 25 00	00	6 99	00
" "	0-18-0	28 50	00	7 86	00

(a) Twenty times the number of units per ton equals the number of pounds per ton

The figures in the column headed "Formula" in Table II show percents of ammonia phosphoric acid, and potash. These percents are equivalent to units and a unit is equal to 20 pounds per ton Thus a fertilizer having the formula 1-12-1 contains 1 percent, or 1 unit, ammonia 12 percent, or 12 units, phosphoric acid, and 1 percent, or 1 unit, potash. Rules converting these percents into equivalent percents of nitrogen phosphorus, and potassium are given on page 2. Thus a fertilizer with the formula 1-12-1 contains in one ton, 20 pounds of ammonia, 240 pounds of phosphoric acid, and 20 pounds of potash, or 16.4 pounds of nitrogen 104.88 pounds of phosphorus, and 16.6 pounds of potassium. The units of plant food per ton of the different fertilizers have been calculated and are given in Table II.

Prices were obtained from all the fertilizers inspected, but in Table II only the minimum, maximum, and average prices are given for the different brands represented by the given formulas. The "average" is the average of the prices obtained from all the different dealers, not the mean between the maximum and maximum. The prices show more than usual variation. For that reason it is very difficult to judge the worth of the figures giving averages.

The cheapest element in the fertilizers in 1921 was phosphorus and this element is needed most. When Kansas farmers buy more phosphorus in their fertilizers the profits in their use will be greater. Fertilizers have been used with the most profit on wheat and alfalfa and phosphorus is the most important element. The percent of phosphorus in wheat grain is 0.6 and in alfalfa hay, 0.175, or there are 0.3 of a pound of phosphorus in each bushel of wheat and 3.6 pounds in each ton of alfalfa hay. One ton of acid phosphate (0-16-0) would then supply all the phosphorus which goes into 466 bushels of wheat or 40 tons of alfalfa hay.

BRANDS OF FERTILIZERS REGISTERED IN KANSAS

The Kansas fertilizer law requires the publication of the list of fertilizers registered and their guaranteed composition. Table III gives this list for the year 1921.[1] A list of Kansas dealers in fertilizers in 1921 and a financial statement covering the period July 1, 1920, to June 30, 1921, are included also in the following pages.

[1] The list of brands of fertilizers registered in Kansas from 1907 to 1919, inclusive, is given in Kansas Inspection Circular 12 (See "Part I, Fertilizer Control in 1919," Table V, pp 26-31). A list of those registered during 1920 is given in Kansas Inspection Circular 16 "Fertilizer Control in 1920" (Table IV)

TABLE III.—BRANDS OF FERTILIZERS REGISTERED IN KANSAS, 1921

NAME OF BRAND	Date of registration		Percent nitrogen	Percent phosphorus in phosphates				Percent potassium soluble in water	Maximum percent of chlorin
				Soluble in water	Available or reverted	Insoluble	Total		
American Agricultural Chemical Company	Mo.	Yr.							
"Empire" Better Than Bone	6	'21	2.47	.....	3.49	.22	3.71	2.49	.....
"Empire" Bone Meal	4	'21	1.65	.....	.....	.....	11.80	.....	.....
"Empire" Bone Black Fertilizer	6	'21	1.65	.....	3.49	.22	3.71	1.66	1.00
"Empire" Bone Black Fertilizer No. 1	6	'21	2.05	.....	3.49	.22	3.71	1.25	.....
"Empire" Bone Black Fertilizer No. 2	6	'21	2.06	.....	3.49	.22	3.71	.....	.....
"Empire" Bone Black Fertilizer 1916	6	'21	2.06	.....	3.49	.22	3.71	.83	.....
"Empire" Crop Grower	6	'21	1.65	.....	3.49	.22	3.71	1.66	1.50
"Empire" Farmers Favorite	6	'21	.82	.....	4.37	.22	4.59	.83	1.00
"Empire" 2–8–5 Fertilizer	6	'21	1.65	.....	3.49	.22	3.71	4.15	.....
"Empire" Heavy Crop	6	'21	1.65	.....	3.49	.22	3.71	2.49	.....
"Empire" Nitrophos	6	'21	1.65	.....	5.24	.22	5.46	.....	.....
"Empire" 16 Percent Phosphate	6	'21	.....	.....	6.99	.22	7.21	.....	.....
"Empire" Potato & Truck Special	6	'21	.82	.....	3.49	.22	3.71	5.81	5.26
"Empire" Steam Bone Substitute	6	'21	1.65	.....	4.37	.22	4.59	.....	.....
Arkansas Fertilizer Company									
White Diamond 18 Percent Acid Phosphate	9	'21	.....	5.24	2.62	.40	8.26	.....	.....
White Diamond 20 Percent Acid Phosphate	9	'21	.....	5.24	3.50	.50	9.24	.....	.....
Armour Fertilizer Works									
Big Crop 20 Percent Acid Phosphate	8	'21	.....	.....	8.73	.22	8.95	.....	.25
Nitrate of Soda	3	'21	14.85	.....	.....	.....	.....	.....	.....
Bone & Potash Fertilizer Company									
Shin Bone	7	'21	.92	.....	3.93	.44	4.37	1.04	.....
Cudahy Packing Company									
Blue Ribbon Fertilizer—Half & Half 1½–20	1	'21	1.50	2.61	2.63	3.49	8.73	.....	.....
Earp-Thomas Cultures Corporation									
Stim-U-plant Tablets	5	'21	11.00	4.50	.50	.20	5.20	12.40	1.60
Interstate Fertilizer Company									
Interstate 0.50–15–2	8	'21	.41	.....	6.54	.22	6.76	1.66	1.00
Interstate Bone & Sheep Manure Mixture 2–14–2	7	'21	1.65	.....	2.04	4.08	6.11	1.66	1.00
Interstate Pure Raw Bone Meal 4½–22	8	'21	3.70	.....	.....	.....	9.60	.....	.....
Interstate Steamed Bone 3 & 24	7	'21	2.46	.....	3.49	6.99	10.48	.....	.....

Morris & Co.									
Big Six	8	'21	.82	.....	.....	.....	6.99	2.49	.....
Big Eight	8	'21	.82	3.49	.....	.44	3.93	.83	.....
Special Big Nine	8	'21	.82	5.24	.....	.44	5.68	.83	.....
Big Ten	8	'21	1.64	3.49	.....	.66	4.15	1.66	.....
Special Big Twelve	8	'21	1.64	5.24	.....	.87	6.11	.....	.....
Swift & Co.									
Swift's Red Steer 12–2 Fertilizer 0–12–2	3	'21	.....	.....	5.24	.22	5.46	1.66	1.50
The Solvay Process Company									
"U-S" Potash	3	'21	.....	.....	.....	.....	.....	44.45	40.56
Tupelo Fertilizer Factory									
Half & Half Bone Meal & Acid Phosphate	8	'21	1.25	.....	4.80	3.94	8.74	.....	.....
Wheat Belt Phosphate & Potash	8	'21	.....	.....	6.55	.43	6.98	1.66	1.50
Virginia-Carolina Chemical Company									
Good as Gold Standard Guano	8	'21	.86	4.20	1.04	.76	6.01	.93	.63
V. C. Ground Tobacco Stems	8	'21	1.65	.....	.....	.....	.....	4.98	.....
V. C. Phospho Tobacco	8	'21	.....	6.37	.72	.42	7.52	.....	.....
Steamed Bone Meal	8	'21	2.50	.....	.....	.....	9.61	.....	.....
Wilson & Co.									
Red "W" Brand Raw Bone Meal	7	'21	3.70	.....	.....	.....	10.05	.....	.....
Red "W" Brand Special Mixture	7	'21	.62	4.37	.87	3.50	8.74	.....	.....
Red "W" Brand Truck Grower 2–8–3	3	'21	1.65	.....	3.50	.80	4.30	2.49	.....

LIST OF KANSAS DEALERS IN FERTILIZERS, 1921

PLACE	DEALER	MANUFACTURER
Aliceville	Aliceville Elevator Company	American Agr Chemical Company
Altamont	Farmers Co-op Elevator Company	Cudahy Packing Company
Altamont	Farmers Co-op Elevator Company	Wilson & Co
Altamont	Libby Brothers	American Agr Chemical Company
Altamont	R H Williams	Swift & Co
Amiot	C L Richardson	Wilson & Co
Angola	E A McCartney	Swift & Co
Arcadia	Dunton Hardware Company	Swift & Co
Atchison	Geo J Fuhrman	Swift & Co
Atchison	Atchison Seed & Four Store Company	Swift & Co
Atchison	B F Rickenberger	Swift & Co
Athens	Piqua Elevator Company	Swift & Co
Baldwin	Jordon & Co	Cudahy Packing Company
Bartlett	E E Bickford	Swift & Co
Baxter	Baxter Springs Bottling Works	Swift & Co
Belleville	P H Jorgensen	Cudahy Packing Company
Birmingham	I B Longnecker & Co	Swift & Co
Bonner Springs	John Brennon	Cudahy Packing Company
Bonner Springs	Frank Schmots	Wilson & Co
Bonner Springs	G F Smith	Wilson & Co
Brasilton	Crawford County Farmers Co-op Assn	Swift & Co
Brasilton	J E Bush	Virginia-Carolina Chemical Company
Bronson	Bronson Grain Company	Cudahy Packing Company
Bucyrus	Chas Heffleboer	Cudahy Packing Company
Burlington	Farmers Co-op Elevator & Mill Co	American Agr Chemical Company
Burlington	Farmers Co-op Elevator & Mill Co	Cudahy Packing Company
Burrton	Ross McMurry	Cudahy Packing Company
Burrton	H C Haskins	Cudahy Packing Company
Carlyle	Iola Mill & Elevator Company	American Agr Chemical Company
Chanute	W B Young	American Agr Chemical Company
Chanute	H Johnson	Wilson & Co
Chapman	A J Poor Elevator Company	Wilson & Co
Cherokee	Kelso Grain Company	Cudahy Packing Company
Chetopa	John F Shields	Swift & Co
Chetopa	Guy Huggins	American Agr Chemical Company
Cimarron	E E Morris	Swift & Co
Coffeyville	Square Deal Seed Company	Swift & Co
Colony	Colony Elevator	Cudahy Packing Company
Columbus	E B Davis	Cudahy Packing Company
Columbus	E B Davis	Phosphated Manure Company
Columbus	Cherokee County Mill & Elevator Co	Wilson & Co
Columbus	J E Laubauch	American Agr Chemical Company
Columbus	Cherokee County Mill & Elevator Co	Interstate Fertilizer Company
Columbus	E B Davis	Swift & Co
Cottonwood Falls	Crawford & Co	Swift & Co
Crestline	Farmers Union Co-op Assn	Swift & Co
Deering	Deering Produce Company	American Agr Chemical Company
Dennis	Farmers Union Co-op Assn	Cudahy Packing Company

PLACE	DEALER	MANUFACTURER
Dennis	Farmers Union Co-op Assn	Swift & Co
Dry Wood	P O Smith	Interstate Fertilizer Company
Dunaway	O A Hawkinson	American Agr Chemical Company
Earlton	Earlton Grange Co-op Assn	Cudahy Packing Company
Earlton	E A & J E George	Swift & Co
Edna	Wilmouth Grain Company	Cudahy Packing Company
Elk Falls	A W Finley	Cudahy Packing Company
Eldorado	I H Powell	Cudahy Packing Company
Elsmore	Elsmore Mill & Elevator Company	American Agr Chemical Company
Elsmore	Elsmore Mill & Elevator Company	Swift & Co
Farlington	Crawford County Farmers Co-op Assn	Swift & Co
Faulkner	P B White	Cudahy Packing Company
Faulkner	Cherokee County Mill & Elevator Co	Wilson & Co
Faulkner	A A Nash	American Agr Chemical Company
Ft Scott	A C Maloney	American Agr Chemical Company
Galesburg	Farmers Union	Phosphated Manure Company
Galesburg	Galesburg Grain Company	American Agr Chemical Company
Girard	John D Miller	Virginia-Carolina Chemical Company
Girard	Crawford County Farmers Co-op Assn	Interstate Fertilizer Company
Girard	J H Cassin	Interstate Fertilizer Company
Girard	Crawford County Farmers Co-op Assn	Swift & Co
Greely	J M Kleinsargie	Wilson & Co
Gridley	O A Hawkinson	American Agr Chemical Company
Gridley	Henry Bahr Hardware Company	Swift & Co
Hallowell	E B Davis	Swift & Co
Hallowell	J M Forbes	Swift & Co
Hamilton	Farmers Union Co-op Assn	Swift & Co
Hartford	Carpenter & West	Cudahy Packing Company
Hartford	O'Connor & Co	Swift & Co
Hartford	F G Welch	American Agr Chemical Company
Herington	Herington Greenhouse	Swift & Co
Hilltop	Ed Huber Company	American Agr Chemical Company
Holton	Bernerd Brothers	Cudahy Packing Company
Howard	McKinley-Barkley	Cudahy Packing Company
Humboldt	Humboldt Mill & Elevator Company	Phosphated Manure Company
Humboldt	E H Leitsbach	American Agr Chemical Company
Humboldt	Humboldt Mill & Elevator Company	American Agr Chemical Company
Humboldt	J A Milhan, County Agent	American Agr Chemical Company
Humboldt	Grange Supply House	Swift & Co
Hutchinson	Underwood Greenhouse Company	Cudahy Packing Company
Independence	Farmers Supply and Exchange	American Agr Chemical Company
Independence	A Zuts & Son	Wilson & Co
Iola	Iola Mill & Elevator Company	American Agr Chemical Company

PLACE	DEALER	MANUFACTURER
Jefferson	D A Dabney	Cudahy Packing Company
Jewett	Linwood Elevator Company	Swift & Co
Junction City	Junction City Floral Company	Swift & Co
Kansas City, Ks	Manly Ettinger	Cudahy Packing Company
Kansas City, Ks	The Southard Poultry Company	Cudahy Packing Company
Kelly	Kelly Farmers Union	Swift & Co
Kincaid	Hensley & Brosius	Swift & Co
Kingman	Wallace Brothers	Swift & Co
La Cygne	K C Leasure	Cudahy Packing Company
La Cygne	C T Potter	Cudahy Packing Company
La Harpe	Samuel Frank Knox	American Agr Chemical Company
La Harpe	Iola Mill & Elevator Company	American Agr Chemical Company
Leavenworth	J A Seacy	Cudahy Packing Company
Leavenworth	Ashby & Sons	Cudahy Packing Company
Liberty	Liberty Co-op Company	American Agr Chemical Company
Madison	W O Waymire	Swift & Co
McCune	Crawford County Farmers Co-op Assn	Swift & Co
McPherson	McPherson Feed Company	Cudahy Packing Company
McPherson	Henry Swanson	Swift & Co
Merriam	E Cross	Wilson & Co
Monmouth	Crawford County Farmers Co-op Assn	Swift & Co
Mont Ida	C S Vanatta	Cudahy Packing Company
Mont Ida	C A Lane	Wilson & Co
Mulvane	Paul & Penley	Swift & Co
Muscotah	M E Bevens	Swift & Co
Nokoma	R Moresch	Swift & Co
Neosho Falls	Anderson & Simmons	American Agr Chemical Company
Neosho Falls	C F Diver	Swift & Co
Neutral	Cherokee County Mill & Elevator Co	Wilson & Co
Neutral	Baxter Springs Bottling Works	Swift & Co
Neutral	E B Davis	Swift & Co
Nortonville	E D W Rathert	Swift & Co
Olathe	H W Speer	Cudahy Packing Company
Olpe	Bradfield & Hathaway	Wilson & Co
Olpe	Jake Brown	American Agr Chemical Company
Olpe	A J Dieboldt	Cudahy Packing Company
Onaga	Peter Guame	Cudahy Packing Company
Oneida	Conwell & Company	Swift & Co
Opolis	Southwest Farm Club	Interstate Fertiliser Company
Opolis	Kelso Grain Company	Cudahy Packing Company
Osage City	Austeatt Brothers	Cudahy Packing Company
Oswego	Chas Perkins	Interstate Fertiliser Company
Paola	B H Sheridan	Cudahy Packing Company
Parnell	Geo J Furhman	Swift & Co
Parsons	Farmers Union Co-op Assn	Swift & Co
Parsons	Farmers Union Co-op Assn	Cudahy Packing Company
Parsons	Farmers Union Co-op Assn	Wilson & Co

Place	Dealer	Manufacturer
Piqua	Piqua Elevator Company	Swift & Co
Piqua	E H Wickel	Cudahy Packing Company
Pittsburg	Kelso Grain Company	Cudahy Packing Company
Pittsburg	Pittsburg Elevator Company	Swift & Co
Potter	Pope & Surritte	Swift & Co
Sabetha	A J Collins	Cudahy Packing Company
Savonburg	Savonburg Farmers Union	Phosphated Manure Company
Scranton	F E Michaels	Swift & Co
Shawnee	Robt McAnany	Wilson & Co
Sherwin	L A Johnson	Wilson & Co
Sherwin	Farmers Union Co-op Assn	American Agr Chemical Company
Southmound	Farmers Union Co-op Assn	Cudahy Packing Company
Southmound	Farmers Union Co-op Assn	Swift & Co
Star Valley	M L Westervelt	American Agr Chemical Company
Sterling	Smyster Manufacturing Company	Cudahy Packing Company
Stippville	L A Johnson	Wilson & Co
St Francis	E W Lowe	Cudahy Packing Company
St Francis	J F Uplinger	Cudahy Packing Company
St Paul	Farmers Co-op Elevator Company	Cudahy Packing Company
St John	Farmers Co-op Elevator Company	Swift & Co
Thayer	Thayer Grange	American Agr Chemical Company
Topeka	D O Coe Seed & Grain Company	Swift & Co
Toronto	Forbes Milling Company	Cudahy Packing Company
Toronto	Holderman & Willhite	American Agr Chemical Company
Turck	J E Laubach	American Agr Chemical Company
Tyro	Dave Mahaffy	Swift & Co
Udall	Henry Shoemaker	Swift & Co
Urbana	Farmers Co-op Business Assn	Cudahy Packing Company
Walnut	Pittsburg Elevator Company	Swift & Co
Walnut	Crawford County Farmers Co-op Assn	Swift & Co
Weir	H W Sutton	Virginia-Carolina Chemical Company
Wellsville	Mignot & Hughes	Wilson & Co
Westphalia	F S Schulte	Cudahy Packing Company
Wilbur	Farmers Union Co-op Assn	American Agr Chemical Company
Wilbur	Ed Huber Company	Swift & Co
Yates Center	Farmers Co-op Elevator Company	Swift & Co

FINANCIAL STATEMENT—FERTILIZER FEES

(July 1, 1920, to June 30, 1921)

RECEIPTS

1920		
	Balance on hand July 1, 1920	$2,512 05
July 1	Morris & Co., tax tags	90 00
July 13	Meridian Fertiliser Company, reg fees	75 00
July 13	Pelican Fertiliser Works, reg fees	75 00
July 13	Interstate Fertiliser Company, tax tags	50 00
July 16	Armour Fertiliser Works, reg fees	25 00
July 19	Meridian Fertiliser Company, tax tags	75 00

1920			
July	19	Morris & Co, tax tags	$60 00
July	19	Swift & Co, tax tags	250 00
July	19	Interstate Fertilizer Company, reg fees	25 00
July	20	Virginia-Carolina Chemical Company, reg fees	50 00
July	22	Armour & Co, tax tags	200 00
July	23	Pulverized Manure Company, tax tags	100 00
July	24	Wilson & Co, tax tags	200 00
July	26	Interstate Fertilizer Company, reg fees	25 00
July	29	Tupelo Fertilizer Factory, tax tags	150 00
July	29	Wilson & Co, reg fees	25 00
Aug	2	Interstate Fertilizer Company, tax tags	50 00
Aug	2	Swift & Co, tax tags	250 00
Aug	9	Tupelo Fertilizer Factory, tax tags	250 00
Aug	9	Armour & Co, tax tags	100 00
Aug	18	Alice Goosen, tax tags	5 00
Aug	19	Virginia-Carolina Chemical Company, tax tags	150 00
Aug	19	Cochrane Packing Company, tax tags	25 00
Aug	19	Tupelo Fertilizer Factory, reg fees	175 00
Aug	19	American Agr Chemical Company, tax tags	250 00
Aug	19	Wilson & Co, tax tags	125 00
Aug	19	Swift & Co, tax tags	250 00
Aug	21	American Agr Chemical Company, tax tags	250 00
Aug	22	Cochrane Packing Company, tax tags	25 00
Aug	22	Swift & Co, tax tags	500 00
Aug	23	Darling & Co, tax tags	75 00
Aug	24	Darling & Co, tax tags	75 00
Sept	7	Meridian Fertilizer Factory, tax tags	25 00
Sept	7	Swift & Co, reg fees	100 00
Sept	7	Darling & Co, tax tags	125 00
Sept	7	P C Floyd Company, tax tags	25 28
Sept	10	Armour & Co, tax tags	100 00
Sept	16	Cudahy Packing Company, tax tags	50 00
Sept	27	Swift & Co, tax tags	250 00
Oct	6	Pulverized Manure Company, tax tags	100 00
Oct	30	United States Gypsum Company, reg fees	25 00
Oct	30	Cudahy Packing Company, reg fees	25 00
1921			
Feb	8	Earp-Thomas Cultures Company, reg fees	25 00
Feb	11	Interstate Fertilizer Company, tax tags	50 00
Feb	25	Planters Cold Storage Company, analysis	6 00
Feb	28	Armour & Co, tax tags	100 00
Feb	28	Earp-Thomas Cultures Company, tax tags	2 50
Mar	28	Armour & Co, reg fees	25 00
Mar	28	Swift & Co, reg fees	25 00
Mar	29	The Solvay Process Company, reg fees	25 00
Mar	29	The Solvay Process Company, tax tags	16 00
April	12	Wickiser, analyses	10 00
April	28	American Agr Chemical Company, reg fees	25 00
April	28	Earp-Thomas Cultures Company, tax tags	2 50
June	13	Swift & Co, tax tags	625 00
June	30	Cudahy Packing Company, tax tags	100 00
		Total receipts	$8,404 48

DISBURSEMENTS

1920			
July	1	Palace Drug Store, goggles	$2 00
July	1	Central Scientific Company, apparatus	25 50
July	16	Business Office, numbering machine	2 00
July	17	Leeds Northrup Company, repairs	4 39
July	24	Central Scientific Company, apparatus	9 75
July	28	Central Scientific Company, apparatus	8 59
July	29	Moore-Cottrell Company, "Soil Science"	6 00
July	30	Manhattan Gas & Electric Company, gas	61 80
July	30	United Telephone Company, phone rent	15 25
July	30	Payroll, student	335 10
July	30	Payroll, employee	90 00
July	30	Payroll, officers	333 33
Aug	3	Building & Repair, repairing centrifuge	7 78
Aug	5	Deegan Supply Company, chemicals	2 50
Aug	25	Manhattan Gas & Electric Company, gas	18 72
Aug	30	Payroll, student	178 50
Aug	30	Payroll, employee	90 00
Aug	30	Payroll, officers	333 33
Sept	1	Eckdall & McCarty, office chair	25 50
Sept	5	Dennison Manufacturing Company, tax tags	202 50
Sept	15	Emmet & Amend, chemicals	2 20
Sept	16	Spot Cash, mustard seed	60

1920

Sept	22	Leeds-Northrup Company, repairs	41 58
Sept	23	C O Swanson, traveling expenses	33 41
Sept	30	Manhattan Gas & Electric Company, gas	38 64
Sept	30	Payroll, student	391 08
Sept	30	Payroll, employee	90 00
Sept	30	Payroll, officers	333 33
Oct	5	Central Scientific Company, apparatus	1 80
Oct	5	Hull's Hardware, plumber's friend	1 00
Oct	13	Central Scientific Company, balance	8 00
Oct	17	Central Scientific Company, apparatus	3 14
Oct	18	Bemis Bag Company, bags	5 80
Oct	20	Grasselli Chemical Company, acid	66 63
Oct	20	Hull's Hardware, dishpan	2 50
Oct	25	C O Swanson, traveling expenses	46 65
Oct	30	Manhattan Gas & Electric Company, gas	12 48
Oct	30	Payroll, student	275 94
Oct	30	Payroll, employee	90 00
Oct	30	Payroll, officers	574 99
Nov	9	Building & Repair, frame for galvanometer	5 81
Nov	10	Building & Repair, repairing fan	16 05
Nov	20	Central Scientific Company, tubing	8 29
Nov	20	Building & Repair, repairing sink	4 89
Nov	20	Building & Repair, repairing muffle	1 76
Nov	25	Manhattan Gas & Electric Company, gas	13 10
Nov	30	Payroll, student	224 06
Nov	30	Payroll, employee	90 00
Nov	30	Payroll, officers	574 99
Dec	1	Eastman Kodak Company, chemicals	22 50
Dec	5	Spot Cash Grocery, jars	2 10
Dec	8	Printing Department, tags	4 22
Dec	9	Printing Department, perforated paper	8 40
Dec	15	Standard Calorimeter Company, bomb	7 01
Dec	25	Manhattan Gas & Electric Company, gas	54 12
Dec	30	Manhattan Gas & Electric Company, gas	54 36
Dec	30	United Telephone Company, rent	13 75
Dec	30	Payroll, student	326 38
Dec	30	Payroll, employee	90 00
Dec	30	Payroll, officers	574 99

1921

Jan	2	Journal of American Agricultural Chemists, subscription	8 00
Jan	5	Central Scientific Company, rubber tubing	2 16
Jan	10	Dennison Manufacturing Company, tax tags	273 60
Jan	8	Building & Repair, repairing	8 98
Jan	12	Building & Repair, repairing line to still	45 49
Jan	12	Building & Repair, repairing still	5 56
Jan	15	Central Scientific Company, rubber stoppers	6 58
Jan	16	Spot Cash Grocery, jars	80
Jan	17	Building & Repair, repairing switch	65
Jan	20	Building & Repair, electrical work	2 78
Jan	22	Building & Repair, light bulbs	1 14
Jan	25	Building & Repair, repairing electric fan	1 55
Jan	25	Dennison Manufacturing Company, blank tags	2 00
Jan	25	Central Scientific Company, glass tubing	17 64
Jan	25	Palace Drug Company, denatured alcohol	3 00
Jan	30	United Telephone Company, rent	2 75
Jan	30	Payroll, student	238 01
Jan	30	Payroll, employee	90 00
Jan	30	Payroll, officers	574 99
Feb	1	Central Scientific Company, glass tubing	2 88
Feb	2	Building & Repair, repair work	2 81
Feb	10	Central Scientific Company, rubber tubing	29 76
Feb	10	Building & Repair, sink and lights	8 84
Feb	11	Building & Repair, repairing electric fan	20 80
Feb	18	Central Scientific Company, "T" tubes	13 24
Feb	19	Eimer & Amend, chemicals	8 70
Feb	20	Eimer & Amend, plumet	6 19
Feb	21	Building & Repair, packing valve for still	5 36
Feb	25	Manhattan Gas & Electric Company, gas	69 24
Feb	28	Payroll, student	97 51
Feb	28	Payroll, employee	90 00
Feb	28	Central Scientific Company, filter paper	6 50
Mar	30	Grasselli Chemical Company, acid	36 25
Mar	30	International Instrument Company, bottles	9 30
April	2	Central Scientific Company, springs for balance	4 00
April	5	Building & Repair, repairing mill	3 61
April	5	Building & Repair, welding	1 15
April	5	Building & Repair, repairing electric muffle	52
April	10	Building & Repair, work on pressure system	7 45

1921		
April 16	Oxygen Gas Company, hydrogen	$2 00
April 20	Heat & Power, oil	8 25
April 25	Deegan Supply Company, beakers	60 45
April 30	United Telephone Company, rent	8 25
April 30	Manhattan Gas & Electric Company, gas	88 17
June 3	J T Baker Chemical Company, chemicals	2 04
June 7	Building & Repair, repairing sink	11 58
June 11	Building & Repair, repairing motor	65
June 12	Building & Repair, brushes for centrifuge	33
June 14	Building & Repair, connect hot plate	8 42
June 18	Building & Repair, weld ball mill	4 00
June 20	Building & Repair, repairing motor	8 59
June 30	United Telephone Company, rent	5 50
June 30	Payroll, employee	90 00
June 30	Payroll, officers	600 02
	Balance on hand June 30, 1921	6 35
	Total	$8,401 48

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