

AGRICULTURAL EXPERIMENT STATION

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DEPARTMENTS OF CHEMISTRY AND AGRONOMY

REPORT ON COMMERCIAL FERTILIZERS IN 1919

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PART I

FERTILIZER CONTROL IN 1919

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FERTILIZER INSPECTION, 1919

The results of the analyses of inspection samples of commercial fertilizers collected during 1919 are presented in Table I. In the spring 19 towns were visited, 25 dealers called upon, and 52 samples, representing 31 brands, were collected. In the fall 20 towns were visited, 26 dealers called upon, and 76 samples, representing 45 brands, were collected. Samples collected in the spring have a lower serial number than 619, those collected in the fall have higher serial numbers,

EXPLANATORY STATEMENTS

The Kansas Fertilizer Law requires that the guaranteed composition of commercial fertilizers be stated in terms of the elements, nitrogen, phosphorus, and potassium. All the figures for composition in Table I are so stated. In fertilizer

literature the terms phosphoric acid and potash are found more frequently than the corresponding terms, phosphorus and potassium. The term ammonia is probably not used more frequently than the corresponding term nitrogen. The agricultural value of a fertilizer in no way depends upon the terms used. That value depends on the amounts of these elements present in a given amount of fertilizer and the form in which they occur.

The relationship existing between the different forms of these fertilizing elements is shown by the following rules for converting any one form into terms of its corresponding form:

Percent nitrogen $\times 1.22 =$ **percent ammonia**
Percent phosphorus $\times 2.29 =$ **percent phosphoric acid**
Percent potassium $\times 1.2 =$ **percent potash**
Percent ammonia $\times 0.82 =$ **percent nitrogen**
Percent phosphoric acid $\times 0.437 =$ **percent phosphorus**
Percent potash $\times 0.83 =$ **percent potassium**

Nitrogen.—In Table I figures for nitrogen represent totals only. The carrier, or the compound in which the element nitrogen is found, has much to do with the value of the nitrogen in a fertilizer. Most nitrogen carriers may be divided into three classes: (1) Mineral salts, (2) by-products from slaughter houses, and (3) by-products from seeds. Sodium nitrate and ammonium sulphate, together with animal tankage and cottonseed meal, furnish four-fifths of the nitrogen used in fertilizers in the United States.¹ Nitrogen in mineral salts is soluble in water and available for immediate use by plants. Nitrogen in tankage and cottonseed meal must undergo change before it is fit for plant use. Nitrogen in any substance that decays rapidly in the soil will be made available for plants during the growing season. Nitrogen from steamed bone meal is in the same class as animal tankage. Nitrogen from animal manure, often used as a filler in the manufacture of fertilizers, is of no more value than an equivalent amount of nitrogen in barnyard manure. The figures for total nitrogen in Table I show that the great majority of mixed fertilizers contain more nitrogen than the guarantee. From this it would appear that if dried animal manure is used as a filler, the nitrogen content of this manure is not figured in by the manufacturer when he makes up his formula. Dried animal manure

¹ Goldenweiser, E. A. Survey of the fertilizer industry. U. S. Dept. Agr. Bul. 798: 1-29. 1919.

makes a good filler because of its conditioning effects. A fertilizer must not only have the required chemical composition, but also must be of such a physical texture that it is an "easy driller."

There are some carriers in which the nitrogen is made available very slowly. Such substances are horn, hoofs, hair, and leather scrap. For this reason manufacturers are prohibited from putting these substances into fertilizers. Such substances can be treated so as to make nitrogen about as available as in animal tankage. One method is by superheated steam, another by sulphuric acid. These treatments so disintegrate these substances that they lose their original identity and also change nitrogenous compounds into forms in which nitrogen is available. In this way inert nitrogenous materials may be changed to valuable fertilizers.

Phosphorus.—Phosphorus is found under three headings in Table I: Phosphorus in phosphates, (1) available or reverted; (2) insoluble; and (3) total. For most of the brands analyzed the figures given for "available or reverted" phosphorus include the soluble in water, if any such be present. Chemically, reverted forms of phosphorus are those which are not soluble in water, but soluble in neutral ammonium citrate solution. Agricultural experiments have shown that phosphorus in water-soluble phosphates and in reverted phosphates have practically the same value,

Phosphorus in insoluble phosphates may not have the same meaning or value in fertilizers of different brands. "Insoluble" from rock phosphate has not the same value, agriculturally, as "insoluble" from bone or tankage. To understand this difference it is necessary to know a few facts about acid phosphate, which is the principal source of phosphorus in mixed fertilizers.

Acid phosphate is made by mixing approximately equal amounts of finely ground rock phosphate and sulphuric acid. One ton of rock phosphate is thus made into two tons of acid phosphate. The action of the sulphuric acid is to change the phosphorus in rock phosphate from a very inert, unavailable form, to forms that are available. Most of the phosphorus in acid phosphate are in forms soluble in water. A smaller amount is in forms soluble in the ammonium citrate solution. In almost all acid phosphates sold as such in this state the amount of the phosphorus in these two available forms is very

nearly 7 percent, which is equivalent to 16 percent phosphoric acid. The amount of phosphorus in insoluble forms in acid phosphate is small; usually it ranges between 0.22 to 0.44 percent.

This insoluble phosphorus has the same value agriculturally as phosphorus from rock phosphate, and if acid phosphate is the source of phosphorus in the mixed fertilizer, the "insoluble" is in the same form as in the rock phosphate and has the same value.

"Insoluble" from bone, however, has a different meaning. Bones used for fertilizers are usually treated with compressed steam. This removes most of the nitrogen and practically all the fat. This process helps to make the phosphorus more available. Very little, if any, of the phosphorus in this steamed bone is soluble in water, the larger portion is soluble in the citrate solution, and a portion is insoluble. This "insoluble" from bone has a different value agriculturally than the insoluble in rock phosphate. Unfortunately we have no chemical method upon which agricultural chemists have been able to agree, which will absolutely distinguish between these two forms. For this reason it would be best for all manufacturers to follow the practice of selling bone goods under a name that will show that the source of phosphorus is bone. Most, but not all, the bone goods sold in Kansas are sold as bone meal and unmixed with anything else. This places bone goods on its merits and avoids a lot of confusion.

Mixing rock phosphate and bone goods is undesirable. The state law does not forbid this, but it is the policy of the Inspection Department to discourage any such mixing.

It is also undesirable to mix bone goods and acid phosphate. The reason for this should appear from what is said in these paragraphs. A large part of the phosphorus from bone goods will appear as insoluble in the analytical report, while only a small amount from acid phosphate is in such form. Thus in a mixed fertilizer containing bone goods and acid phosphate, the "insoluble" from bone is not given any more credit in the inspection report than the "insoluble" from acid phosphate which in reality has the same value as phosphorus from rock phosphate, while the insoluble phosphorus from bone is much more valuable.

Potassium.—The only forms of potassium recognized by the state law are those soluble in water. The original source of

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this potassium makes no difference provided that it does not contain deleterious substances. Borax is one of the most important deleterious substances which may be present in potassium salts. When imported potassium furnished the potassium in the fertilizers, borax was no problem. But certain domestic supplies have considerable of this substance. Borax is known to be injurious to plant life and because considerable injury has been caused by fertilizers containing borax, the United States Department of Agriculture has ruled that not more than one-tenth of 1 percent of anhydrous borax shall be present in any fertilizer, unless the containers are marked or tagged so as to show plainly and conspicuously the percent of borax present. The United States Department of Agriculture has determined, from the best information available, that the limit of safety is two pounds of anhydrous borax per acre, when applied in the drill, and ten pounds per acre when broadcasted. This ruling was made not to exclude borax, because potassium salts from all sources, whether domestic or foreign, contain traces of borax. The ruling was made so that fertilizers containing borax may be used in such amounts as not to be injurious to crops. As very seldom as much as 2,000 pounds of fertilizers per acre are used, it is not necessary that one-tenth of 1 percent be the maximum percent of borax. The following table shows the amount of fertilizers of different borax content that can be used without exceeding the limits of two pounds per acre drilled, and ten pounds per acre broadcasted.

PERCENT OF BORAX IN MIXED FERTILIZERS	AMOUNT OF FERTILIZER THAT CAN BE USED PER ACRE	
	To drill two pounds borax per acre	To broadcast ten pounds borax per acre
	<i>Pounds</i>	<i>Pounds</i>
2.0.....	100	500
1.5.....	133	665
1.0.....	200	1,000
.9.....	220	1,100
.8.....	250	1,250
.7.....	285	1,425
.6.....	333	1,665
.5.....	400	2,000
.4.....	500	2,000
.3.....	665	2,000
.2.....	1,000	2,000
.1.....	2,000	2,000

Because of the danger from borax, the fertilizers sampled in Kansas during 1919 were tested for borax. Qualitative tests showed that in the majority of fertilizers sold, borax was present only in traces or less than one-tenth of 1 percent.

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ANALYSES OF INSPECTION SAMPLES

The results of the analyses of inspection samples given in Table I are summarized as follows:

	TOTAL ANALYSES	NUMBER DEFICIENT	PERCENT DEFICIENT
Total nitrogen	98	11	11.2
Phosphorus in available forms	86	12	13.8
Total phosphorus	110	5	4.5
Potassium	61	20	33.0

The number of samples which were below the legal guarantee in nitrogen was not so large as those that were above the guarantee. Approximately one sample in seven was below the legal guarantee in available phosphorus, while in total phosphorus only one sample in twenty was below. This unfavorable showing in available phosphorus as compared with total phosphorus was probably due to the use of bone goods in mixed fertilizers. The worst deficiencies were in potassium. One sample in three was below the legal guarantee. This is worse than in any previous report. Such deficiencies if persisted in will call for cancellation of the registrations and prohibition of the sales of the brands in question.

TABLE 1.—Results of Analyses of Inspection
Samples of Fertilizers, 1919

(Pages 8 to 13, inclusive)

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TABLE I.—RESULTS OF ANALYSES OF INSPECTION SAMPLES OF FERTILIZERS, 1919

MANUFACTURER, BRAND ON SALE, AND DEALER	Composition guaranteed (G) and found (F)	Percent nitrogen	Percent phosphorus in phosphates			Percent potassium soluble in water	Percent chlorine
			Available or reverted	Insoluble	Total		
Armour & Co.							
ARMOUR'S 1-10-0 FERTILIZER.....	G	0.82	4.37	0.22	4.59	.....	0.50
567 Pittsburg Mod. Mfg. Co., Pittsburg.....	F	1.08	4.27	.92	5.19	.....	.10
639 L. B. Van Slyke, Altamont.....	F	1.04	5.03	1.52	6.55	.....	.....
ARMOUR'S 1-8-1 FERTILIZER.....	G	.82	3.49	.22	3.71	0.83	1.00
568 Pittsburg Mod. Mfg. Co., Pittsburg.....	F	.94	3.53	.67	4.20	.92	.50
ARMOUR'S AMMONIATED PHOSPHATE.....	G	1.65	4.37	.22	4.59	.....	1.00
569 Pittsburg Mod. Mfg. Co., Pittsburg.....	F	1.76	4.46	1.04	5.50	.....	.50
HELMET BRAND FINE GROUND BEEF BONE.....	G	2.47	2.62	7.86	10.48	.....	.....
577 Cherokee Co. Mill & Elev. Co., Columbus.....	F	2.93	.....	.....	10.07	.....	.....
632 Cherokee Co. Mill & Elev. Co., Columbus.....	F	2.83	.....	.....	10.02	.....	.....
622 Pittsburg Mod. Mfg. Co., Pittsburg.....	F	2.76	.....	.....	10.16	.....	.....
676 H. L. Jaqueth, Galena.....	F	2.89	2.93	7.08	10.01	.....	.....
ARMOUR'S 1-12-1 FERTILIZER.....	G	.82	5.24	.22	5.46	.83	1.00
578 Cherokee Co. Mill & Elev. Co., Columbus.....	F	.88	5.12	.90	6.02	1.08	.40
638 L. B. Van Slyke, Altamont.....	F	1.08	5.60	.83	6.43	.83	.32
633 Cherokee Co. Mill & Elev. Co., Columbus.....	F	1.03	5.69	.68	6.37	.86	.35
620 Pittsburg Mod. Mfg. Co., Pittsburg.....	F	.90	5.47	.62	6.09	.75	.19
ARMOUR'S HELMET 16 PERCENT PHOSPHATE.....	G	.....	6.99	.22	7.21	.....	.25
601 Kelso Grain Co., Weir.....	F	.....	6.73	1.06	7.79	.....	.....
635 Cherokee Co. Mill & Elev. Co., Columbus.....	F	.....	7.90	.79	8.69	.....	.....
619 Pittsburg Mod. Mfg. Co., Pittsburg.....	F	.....	7.78	.46	8.24	.....	.....
HELMET BRAND NO. 2-8-2 FERTILIZER.....	G	1.65	3.49	.....	3.49	1.66	1.65
621 Pittsburg Mod. Mfg. Co., Pittsburg.....	F	1.66	3.20	.94	4.14	1.76	.88
ARMOUR'S HELMET BRAND RAW BONE MEAL.....	G	3.71	2.18	8.30	10.48	.....	.....
677 H. L. Jaqueth, Galena.....	F	4.58	3.85	6.32	10.17	.....	.....
ARMOUR'S HELMET BRAND SPECIAL POTATO FERTILIZER.....	G	1.65	3.49	.....	3.49	8.80	.....
605 Kelso Grain Co., Cherokee.....	F	1.68	3.42	1.03	4.45	8.78	1.30

American Agricultural Chemical Company							
EMPIRE BONE BLACK FERTILIZER No. 2							
583	H. L. Jaqueth, Crestline	G	2.06	3.49	.27	3.76	.10
		F	2.25	3.98	.85	4.83	
STEAM BONE SUBSTITUTE							
584	H. L. Jaqueth, Crestline	G	1.65	4.36	.27	4.63	.10
		F	1.71	5.09	.51	5.60	
EMPIRE ECONOMY MIXTURE							
585	H. L. Jaqueth, Crestline	G	.82	4.37	.22	4.59	.20
		F	1.11	4.84	.51	5.35	
EMPIRE 16 PERCENT PHOSPHATE							
652	Edgar Zumbo, Cherryvale	G		6.98	1.74	8.72	
665	Kelso Grain Co., Weir	F		8.12	.21	8.33	
		F		7.31	.52	7.83	
Cudahy Packing Company							
CUDAHY BLUE RIBBON STEAM BONE MEAL							
637	Cherokee Co. Mill & Elev. Co., Columbus	G	2.47			10.48	
660	Kelso Grain Co., Pittsburg	F	3.27			11.47	
		F	4.42			(a)9.28	
Cochrane Packing Company							
COCHRANES CORN & WHEAT GROWER							
576	Pittsburg Elev. Co., Pittsburg	G	1.08	3.48	.50	3.98	1.08 .30
656	Chanute Grain Co., Chanute	F	1.09	3.46	.87	4.33	1.05 .20
		F	.88	3.99	.37	4.36	.58 .20
COCHRANES CHAMPION GRAIN GROWER							
655	Chanute Grain Co., Chanute	G	1.65	4.87	.22	4.59	.88
		F	2.23	3.32	1.01	4.33	.99 .42
Fertile Chemical Company							
NITRO-FERTILE							
617	D. O. Coe Grain & Seed Co., Topeka	G	2.00	(b) 1.81		1.81	3.00 2.60
		F	2.86	(b) 1.74		1.74	3.88 1.83
Interstate Fertilizer Company							
INTERSTATE 2-12-2							
673	Chas. D. Thomas, Baxter Springs	G	1.65	5.24	.22	5.46	1.66 1.00
		F	1.70	3.95	2.07	6.02	1.64 .44
STEAM BONE MEAL 1-23-0							
624	Kelso Grain Co., Pittsburg	G	.82	3.17	9.49	12.66	
636	Cherokee Co. Mill & Elev. Co., Columbus	F	.95	4.46	9.42	13.88	
		F	.82	5.12	9.57	14.69	
INTERSTATE 1-12-1							
623	Kelso Grain Co., Pittsburg	G	.82	5.24	.22	5.46	.83 1.00
631	Cherokee Co. Mill & Elev. Co., Columbus	F	1.11	3.86	2.51	6.47	.83 2.17
		F	1.34	3.00	1.55	5.15	.86 3.08
INTERSTATE 2-12-0							
640	Libby Bros., Altamont	G	1.65	5.24	.22	5.46	
		F	1.98	4.31	1.64	5.95	.18
INTERSTATE RAW BONE MIXTURE 2-16-0							
641	Libby Bros., Altamont	G	1.65	3.49	3.49	6.98	1.00
		F	2.04	4.68	2.92	7.60	

TABLE I.—CONTINUED

MANUFACTURER, BRAND ON SALE, AND DEALER	Composition guaranteed (G) and found (F)	Percent nitrogen	Percent phosphorus in phosphates			Percent potassium soluble in water	Percent chlorine
			Available or reverted	Insoluble	Total		
The Pulverized Manure Company							
WIZARD BRAND PHOSPHATED MANURE.....	G	.82	3.79	.....	3.79	1.00	.18
691 C. T. Potter, LaCygne.....	F	1.05	4.20	.32	4.52	1.13	.12
659 The Pulverized Manure Co., Kansas City...	F	.91	4.61	.13	4.74	.76	.....
Thomas Ruddy Company							
RUDDY'S CORN & WHEAT SPECIAL 1-12-1.....	G	.82	5.24	.20	5.44	.83	1.50
686 Crawford Co. Farmers' Union, Girard.....	F	1.34	4.92	1.47	6.39	.42	.12
688 Farmers' Union, Parsons.....	F	.73	4.71	2.13	6.84	.80	.....
671 E. B. Davis, Columbus.....	F	1.08	5.22	1.81	7.03	.65	.....
626 Kelso Grain Co., Pittsburg.....	F	1.60	4.88	2.52	7.40	.92	.62
596 The Farmers' Union Cooperative Assn., Parsons...	F	.68	5.13	.73	5.86	.088	.....
602 Kelso Grain Co., Cherokee.....	F	.91	5.71	.51	6.22	.12	.....
610 Grange Supply Co., Humboldt.....	F	1.05	4.31	2.26	6.57	.11	.....
612 Woodson Company, Yates Center.....	F	.81	5.79	.18	5.97	.16	.....
616 Farmers' Wholesale Supply Co., Emporia.....	F	.73	5.12	1.28	6.40	.092	.....
RUDDY'S STANDARD GRAIN GROWER 1-10-1.....							
595 Farmers' Union Cooperative Assn., Parsons.....	G	.82	4.37	.22	4.59	.83	1.50
611 Grange Supply Co., Humboldt.....	F	.81	3.84	.77	4.61	.24	.....
.....	F	.94	4.19	.93	5.12	.12	.....
RUDDY'S AMMONIATED BONE FERTILIZER 1-23-0.....							
685 Crawford Co. Farmers' Union, Girard.....	G	.82	4.25	3.75	10.00	.....	.....
684 Farmers' Union, Parsons.....	F	1.01	2.54	7.50	10.04	.....	.....
662 Kelso Grain Co., Cherokee.....	F	1.31	3.08	7.11	10.79	.....	.....
629 Kelso Grain Co., Pittsburg.....	F	1.21	4.44	5.07	9.51	.....	.....
594 The Farmers' Union Cooperative Assn., Parsons.....	F	.98	9.72	1.82	11.54	.....	.316
588 Altamont Grange, Altamont.....	F	.77	3.36	2.98	6.34	.....	.10
.....	F	1.57	3.83	.97	4.80	.....	.10
RUDDY'S 16 PERCENT ACID PHOSPHATE.....							
625 Kelso Grain Company.....	G	.....	6.99	.22	7.21	.....	.....
.....	F	.....	7.27	1.45	8.72	.....	.....
Swift & Co.							
SWIFT'S DIAMOND "K" GRAIN GROWER.....	G	.82	5.24	.22	5.46	.83	1.50
570 Pittsburg Elev. Co., Pittsburg..	F	.94	5.50	.52	6.02	.67	.20
580 E. B. Davis, Columbus.....	F	.67	5.85	.67	6.52	.67	.30
587 Libby Bros., Altamont.....	F	1.33	5.05	.47	5.52	.81	.20
597 Allen Grain Co., Coffeyville.....	F	1.18	5.13	.53	5.66	.49	.30
614 Haines Hardware Co., Emporia.....	F	1.40	4.97	.68	5.65	.49	.20

657 Haines Hardware Co., Emporia.....	F	1.08	5.57	.45	6.02	.95	.50
679 Allen Grain Co., Coffeyville.....	F	.80	6.36	.88	7.24	.68	
688 Crawford Co. Farmers' Union, Girard.....	F	1.27	5.11	.61	5.72	.60	.18
SWIFT'S 1 1/4-30-0 BONE MEAL FERTILIZER.....							
650 Cherryvale Grain Co., Cherryvale.....	G	1.08			13.11		
646 J. F. Shields, Chetopa.....	F	1.31			12.89		
644 Van Alstein Corporation, Oswego.....	F	1.48			12.63		
642 Libby Bros., Altamont.....	F	1.32			11.86		
687 Crawford Co. Farmers' Union, Girard.....	F	1.34			12.02		
678 Allen Grain Co., Coffeyville.....	F	1.44			12.31		
672 E. B. Davis, Columbus.....	F	1.31			12.44		
661 Pittsburg Elev. Co., Pittsburg.....	F	1.28			12.26		
572 Pittsburg Elev. Co., Pittsburg.....	F	1.36			13.14		
582 E. B. Davis, Columbus.....	F	1.37			12.95		
592 J. F. Shields, Chetopa.....	F	1.52			13.17		
599 Allen Grain Co., Coffeyville.....	F	1.40			13.30		
603 Kelso Grain Co.....	F	1.89			12.47		
	F	1.70			12.21		
SWIFT'S CHAMPION WHEAT & CORN GROWER.....							
648 J. F. Shields, Chetopa.....	G	1.65	5.24	.22	5.46	1.66	1.88
645 Van Alstein Corporation, Oswego.....	F	1.89	5.50	.65	6.15	1.89	.10
680 Allen Grain Co., Coffeyville.....	F	1.51	5.98	.95	6.98	1.57	
	F	1.41	4.17	.75	5.92	1.58	1.54
SWIFT'S SPECIAL GRAIN FERTILIZER.....							
647 J. F. Shields, Chetopa.....	G	1.65	4.37	.43	4.80	1.66	1.51
643 Libby Bros., Altamont.....	F	1.80	4.40	.80	5.20	2.40	.017
689 C. T. Potter, LaCygne.....	F	1.36	5.27	.83	6.10	1.66	.025
651 Cherryvale Grain Co., Cherryvale.....	F	2.25	4.40	.77	5.17	.99	.30
	F	1.62	4.30	.63	4.93	1.75	.35
SWIFT'S 0-14-2 FERTILIZER..							
690 C. T. Potter, LaCygne.....	G		6.11	.44	6.55	1.66	1.50
	F		6.10	.11	6.21	1.79	
SWIFT'S TOP DRESSING FERTILIZER..							
682 Allen Grain Co., Coffeyville.....	G	2.47	3.49	.44	3.98		1.50
598 Allen Grain Co., Coffeyville.....	F	1.62	4.41	.46	4.87		
	F	2.56	4.30	.44	4.74		.20
SWIFT'S COMPLETE FERTILIZER..							
575 Pittsburg Elev. Co., Pittsburg.....	F	.82	3.49	.44	3.98	.83	1.50
	F	.96	3.72	.36	4.08	.91	.10
SWIFT'S SPECIAL BONE MEAL PHOSPHATE...							
670 E. B. Davis, Columbus.....	G	.82			8.74		
	F	.91			8.80		

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	Percent chlorine
			Available or reverted	Insoluble	Total		
SWIFT'S AMMONIATED BONE PHOSPHATE & POTASH..	G	1.64	4.37	.20	4.57	.41	1.50
573 Pittsburg Elev. Co., Pittsburg	F	1.53	4.53	.54	5.07	.57	.20
581 E. B. Davis, Columbus	F	1.18	4.58	.82	5.40	.54	.20
591 J. F. Shields, Chetopa	F	1.14	4.51	1.10	5.61	.50	.30
600 Allen Grain Co., Coffeyville	F	1.68	4.59	.46	5.05	.45	.....
SWIFT'S SUPERPHOSPHATE.....	G	1.65	3.49	.44	3.93	1.66	1.51
574 Pittsburg Elev. Co., Pittsburg	F	1.44	4.55	.42	4.97	1.02	.40
SWIFT'S TOMATO & VEGETABLE FERTILIZER.....	G	2.46	3.49	.20	3.69	.41	1.50
609 W. B. Young & Co., Chanute	F	1.90	4.08	.48	4.56	.55	.30
SWIFT'S HIGH GRADE ACID PHOSPHATE..	G	.....	6.99	.22	7.41	.....	.....
658 Haines Hardware Co., Emporia	F	.....	.....	.10	7.94	.....	.....
SWIFT'S DIAMOND "L" GRAIN GROWER.....	G	1.65	5.24	.22	5.46	.83	1.28
654 W. B. Young & Co., Chanute	F	1.39	5.69	1.11	6.80	1.00	.50
SWIFT'S PURE RAW BONE MEAL..	G	3.70	.....	.....	10.04	.....	.....
653 W. B. Young & Co., Chanute	F	4.02	.....	.....	10.33	.....	.....
SWIFT'S AMMONIATED BONE PHOSPHATE & POTASH..	G	1.65	4.37	.43	4.80	.42	1.50
681 Allen Grain Co., Coffeyville	F	1.73	5.58	.38	5.98	.49	.....
The Virginia-Carolina Chemical Company							
MONARCH GRAIN GROWER.....	G	.....	6.55	.95	7.50	1.66	.70
675 Stauffer Cammack Grain Co., Baxter Springs	F	.....	6.76	.83	7.59	1.73	.....
668 Stauffer Cammack Grain Co., Columbus	F	.....	7.23	.60	7.88	1.46	.42
BONE MEAL MIXTURE.....	G	3.80	.....	.....	8.80	.....	.....
674 Stauffer Cammack Grain Co., Baxter Springs	F	3.113	.....	.....	8.17	.....	.....
669 Stauffer Cammack Grain Co., Columbus	F	3.34	.....	.....	8.75	.....	.....
V. C. SUPERPHOSPHATE..	G	.....	7.10	.42	7.52	.....	.28
667 Stauffer Cammack Grain Co., Columbus	F	.....	7.40	.24	7.64	.....	.....
627 H. W. Sutton, Weir	F	.....	7.84	.14	7.98	.....	.....

Wilson & Co.								
	WILSON SPECIAL BONE MEAL.....	G	.82				13.00	
692	J. L. Teagarden, LaCygne.....	F	1.85				12.87	
	WILSON'S BONE MEAL & ACID PHOSPHATE.....	G	.82	6.25	3.75		10.00	
693	J. L. Teagarden, LaCygne.....	F	1.08	7.92	3.00		10.92	
634	Cherokee Mill & Elev. Co., Columbus..	F	.77	5.47	5.68		11.15	
	WILSON'S RED "W" GRAIN GROWER..	G	.82	5.24	.26		5.50	.88
630	Cherokee Co. Mill & Elev. Co., Columbus ..	F	.99	5.96	.79		6.75	.66
								.133

(a) Figures in bold-face type indicate that the amount found was below the allowed minimum.
 (b) All water-soluble.

CHIEF PROVISIONS OF KANSAS FERTILIZER LAW

Definition of a Commercial Fertilizer.—Any substance is considered a commercial fertilizer if by reason of its chemical composition it is sold for the purpose of increasing the crops produced by land. Ground rock phosphate and sulphur are considered fertilizers when sold for fertilizing purposes. The law, however, exempts raw materials in the hands of manufacturers, also salt, lime, gypsum, or the dung of domestic animals, when each is sold under its own name and unmixed.

Registration.—Before any commercial fertilizer can be legally sold in Kansas it must be officially registered with the Director of the Agricultural Experiment Station. The cost of this registration is \$25 and is permanent unless revoked for cause.

Statement of Guarantee.—The manufacturers must submit a statement of the guaranteed composition of the fertilizer in the following terms:

1. **Minimum percent of phosphorus in phosphates soluble in water.**
2. **Minimum percent of phosphorus in reverted phosphates,**
3. **Minimum percent of phosphorus in insoluble phosphates.**
4. **Minimum percent of total phosphorus.**
5. **Minimum percent of potassium in compounds soluble in water.**
6. **Maximum percent of chlorine in compounds soluble in water.**
7. **Minimum percent of total nitrogen.**

The manufacturer also guarantees that the fertilizer contains no horn, hoof, hair, feather, or similarly inert nitrogenous matter, the nitrogen in such substances being so inert as to have no value. No change may be made in the guaranteed composition without a re-registration.

Statement of Ingredients.—The manufacturer must submit in his application a statement of the ingredients which he proposes to use in the manufacture of the fertilizer. The purpose of this is that those who have the fertilizer control in charge may know that no injurious or worthless materials are to be used in the manufacture of the fertilizer.

No change may be made in the general character of the materials used in the manufacture of a fertilizer without a re-registration.

Inspection Tax.—Inspection tax at the rate of 25 cents per ton, or 2½ cents per package of 200 pounds or fraction thereof, is collected on all fertilizers sold in Kansas. On every package or bag containing fertilizers there must be attached one tag showing that the tax has been paid. When fertilizers are sold in bulk, there must be one tag for each 200 pounds or fraction thereof. This applies to all fertilizers sold for ordinary farm purposes. There are, however, some fertilizers sold in very small packages. These are usually intended for flowers. In such cases a special ruling applies. Further information will be furnished to those interested.

Use of Money.—The money collected from the sale of tax tags and registrations is used first to defray the expenses of inspection and analysis of commercial fertilizers sold in the state. Any money received in excess of this need is used for agricultural investigations. The policy has been adopted of using such money for work on soil projects. Thus the fertilizer trade indirectly receives the benefit of any excess collected under the fertilizer law. The law requires that an account shall be made to the State Treasurer for all money collected or expended. In compliance with this provision, each inspection circular contains a financial statement.

Guarantee Tags.—Every package of fertilizer shall bear a label on which shall be given the following information: (1) Name and address of manufacturer. (2) Brand of fertilizer. (3) Number of net pounds in the package. (4) Chemical composition in the terms stated under "Statement of Guarantee."

Some manufacturers make these statements on the reverse side of the tax tag. There is no technical objection to this, provided the printing is plain. Sometimes, however, a rubber stamp is used and the letters and figures are illegible. If the statement of guarantee has any value it must be legible. Some manufacturers print this statement on the bag. This procedure is also approved, but it is very difficult to read the figures on many of the bags. The best procedure seems to be to have a separate tag on which the guarantee is plainly printed.

Attachment of Tags.—No entirely satisfactory method of attaching the tags has been devised. Most tags are attached with hooks. This is probably the most satisfactory method

from the standpoint of convenience in putting them on, but they are easily torn off. This is especially true when the tags are put on the bottoms or sides of the bags. They are less likely to be torn off when placed on top and between the ears of the bag. Sometimes tags are not attached at the factory, but shipped separately to the agent. This is a bad practice. Experience has shown that very often these tags are not put on, but are left in a pile beside the bags. This is contrary to that provision of the law which says that "every package shall bear a tag."

The law contains the necessary provisions for its enforcement and provides penalties for violations. A circular giving the law in full will be mailed on request.

SALE OF FERTILIZERS IN KANSAS

The amount of fertilizers sold in Kansas has increased materially during the last three years. There are two methods of getting at the amount of fertilizers sold: (1) Sales of tax tags, and (2) reports of sales from manufacturers. The total number of tons sold according to each of these methods of calculation is as follows:

Year	Figures from sales of tax tags	Figures from manufacturers' reports
1917.....	8,068	6,870
1918.....	10,585	10,600
1919.....	16,937	12,412

In 1917, 200 pound bags were generally used for commercial fertilizers. In 1919, practically all shipments were made in 125-pound bags. The Kansas law does not mention the 125-pound bag, but requires a tag to be placed on each package of 200 pounds or fraction thereof. Because of the common practice under these conditions, figures for sales based on tax tags are calculated on the basis of one tag for each 125 pounds sold.

Because of these facts the calculated sales for 1917, based on the sales of tax tags, are probably too low. If all fertilizers sold that year had been packed in 200-pound bags the total amount sold would have been 12,900 tons. For the same year the calculated sales based on reports from manufacturers are also probably too low, as the records for that year are some-

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what incomplete. In the fall of 1919 evidently a much larger sale was anticipated than actually took place. This is probably the reason for the differences in the two figures for that year.

Most of the fertilizers sold in Kansas are used in the south-eastern portion. Figure 1 shows the distribution of sales for 1919. It must be remembered that a fertilizer bought in a county is not necessarily used in that county if the shipping point is near the county line. The leading counties in order of tons sold in each are: Cherokee, Labette, Crawford, Neosho, Allen. In eleven other counties the reported sales are somewhat over 200 tons in each per year. In the rest of the east-

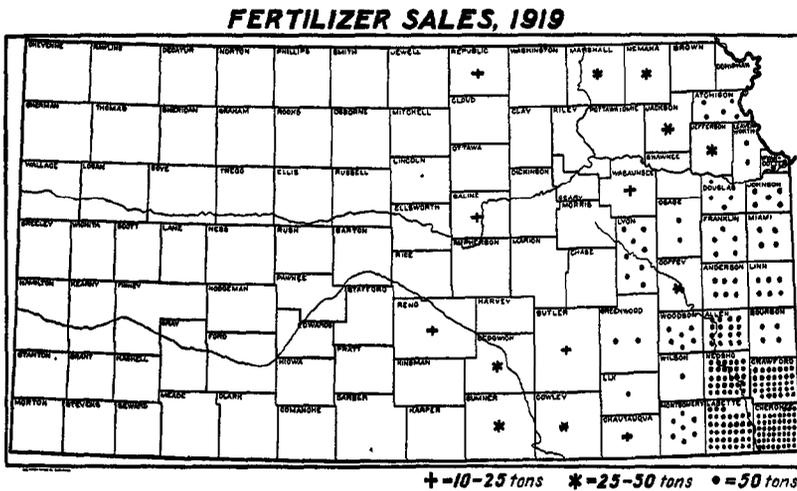


Fig. 1.—Map showing the number of tons of fertilizer sold in the different counties of Kansas in 1919

ern third of the state the sales amount to less than 200 tons per county per year. In the central and western part of the state very little fertilizer is sold.

Table II gives further details regarding the sales of commercial fertilizers in Kansas, 1917 to 1919, inclusive. Mixed goods means mixed fertilizers containing nitrogen, phosphorus, usually from acid phosphate, and generally, but not always, potassium. Bone goods includes all the bone meals.

The table shows that a little more than half the fertilizers sold in the state are mixed goods. From 3 to 7 times as much

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bone goods are sold as acid phosphate. However, the three years show a progressive increase in the amount of acid phosphate used. This must of necessity be the case when the amount of fertilizers sold in the state is on the increase. The amount of bone goods available for fertilizers is a limited quantity, while the amount of acid phosphate available depends on the capacity of the fertilizer plants. The largest trade in fertilizers occurs in the fall, the sales at that season being from 2 to 5 times the amount sold in the spring.

TABLE II.—SALES OF FERTILIZERS IN KANSAS,
 1917 TO 1919 INCLUSIVE

	1917	1918	1919
MIXED GOODS	<i>Tons</i>	<i>Tons</i>	<i>Tons</i>
Spring.....	918.77	931.45	1,446.21
Fall.....	2,493.14	5,136.15	5,450.85
Total.....	3,408.91	6,067.60	6,897.06
BONE GOODS			
Spring.....	146.80	132.05	440.11
Fall.....	2,828.55	3,814.97	3,686.82
Total.....	2,975.35	3,997.02	4,126.93
ACID PHOSPHATE			
Spring.....	478.06	21.90	97.85
Fall.....	8.40	511.00	1,289.65
Total.....	486.46	532.90	1,387.50
TOTAL FERTILIZERS			
Spring.....	1,538.63	1,195.40	1,984.17
Fall.....	5,330.09	9,462.12	10,427.32
Grand total	6,868.72	10,597.52	12,411.49

PRICE OF COMMERCIAL FERTILIZER

A ton of a commercial fertilizer is valuable to a farmer because it contains a certain amount of plant food in forms available for plant growth, chiefly during the season in which the fertilizer is applied. In the early part of 1919 a study was made of the prices of commercial fertilizers prevailing during the year 1918. This study revealed the following facts which were published in a press bulletin.

1. Bone meal was the most economical fertilizer for the farmer to buy. That is, in bone meal the farmer could obtain a larger number of pounds of nitrogen and phosphorus for a certain amount of money than in any other fertilizer.

2. Acid phosphate was next to bone meal the most economical fertilizer to buy. This fertilizer furnishes only phosphorus.

3. The ordinary mixed commercial fertilizer was the most expensive for the farmer to buy and use on his crop, and the so-called low-grade fertilizer was more expensive than the high-grade. A fertilizer containing 14 or more units of plant food is classed as high-grade.

COMPARISON OF DEALERS' PRICES, 1919

During the inspection work of 1919, prices were obtained direct from local dealers. These prices are given in Table III. In publishing them it is thought best to omit the names of dealers, manufacturers, and brands, and to distinguish the different fertilizers by the formulas and classes. There were three classes of fertilizers; namely, (1) mixed goods, (2) bone meal, and (3) acid phosphate. Acid phosphate furnishes the element phosphorus only. Bone meal furnishes phosphorus and nitrogen. There are three groups of mixed goods depending on what elements are furnished: (1) Mixed goods carrying nitrogen, phosphorus, and potassium; designated mixed goods, N. P. K. (2) Mixed goods carrying phosphorus and potassium; designated mixed goods, P. K. (3) Mixed goods carrying nitrogen and phosphorus; designated mixed goods, N. P.

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TABLE III.—DEALERS' PRICES ON COMMERCIAL FERTILIZERS, 1919

DESCRIPTION OF FERTILIZER	Formula	Price per ton	Pounds of plant food per ton		
			Nitrogen	Phosphorus	Potassium
Spring, 1919					
Mixed goods, N P K.....	1-8-1	{Min. \$88.00 Max. 40.00 Av. 39.00}	16.4	69.9	16.6
" " " " ".....	1-10-1	{Min. 38.00 Max. 39.00 Av. 38.38}	16.4	87.4	16.6
" " " " ".....	1-12-1	{Min. 40.00 Max. 45.00 Av. 42.16}	16.4	104.8	16.6
" " " " ".....	2-8-2	58.00	32.8	69.9	33.2
" " " " ".....	2-8-10	60.00	32.8	69.9	166.0
" " " " ".....	2-10-0.5	{Min. 42.00 Max. 46.00 Av. 44.60}	32.8	87.4	8.3
" " " " ".....	1¼-8-1¼	38.75	20.5	69.9	20.8
Mixed goods, N P.....	1-10-0	{Min. 38.00 Max. 36.00 Av. 35.60}	16.4	87.4	00.0
" " " " ".....	2-10-0	40.00	32.8	87.4	00.0
" " " " ".....	2¼-8-0	43.00	36.9	69.9	00.0
" " " " ".....	8-8-0	48.00	49.2	69.9	00.0
Bone meal.....	1-23-0	41.00	16.4	201.0	00.0
Mixed goods, N P.....	2¼-23-0	52.75	41.0	201.0	00.0
Bone meal.....	1¼-30-0	{Min. 45.00 Max. 48.50 Av. 46.50}	20.5	262.2	00.0
" " ".....	3-24-0	{Min. 43.75 Max. 48.00 Av. 45.88}	49.2	209.6	00.0
Acid phosphate, P.....	0-16-0	28.00	00.0	139.8	00.0
Fall, 1919					
Mixed goods, N P K.....	1-8-1	30.00	16.4	69.9	16.6
" " " " ".....	1-8-1¼	32.00	16.4	69.9	20.8
" " " " ".....	1¼-8-1¼	38.00	20.5	69.9	20.8
" " " " ".....	1-12-1	{Min. 38.00 Max. 36.50 Av. 34.83}	16.4	104.8	16.6
" " " " ".....	2-8-2	40.00	32.8	69.9	33.2
" " " " ".....	2-10-½	37.75	32.8	87.4	8.3
" " " " ".....	2-10-1	42.00	32.8	87.4	16.6
" " " " ".....	2-10-2	{Min. 40.75 Max. 42.00 Av. 41.58}	32.8	87.4	33.2
" " " " ".....	2-12-2	{Min. 42.50 Max. 44.50 Av. 43.50}	32.8	104.8	33.2
Mixed goods, N P.....	1-10-0	34.50	16.4	87.4	00.0

REPORT ON COMMERCIAL FERTILIZERS

TABLE III.—CONCLUDED

DESCRIPTION OF FERTILIZER	Formula	Price per ton	Pounds of plant food per ton		
			Nitrogen	Phosphorus	Potassium
Bone meal	1-23-0	{ Min. 41.50 Max. 42.00 Av. 41.87 }	16.4	201.0	00.0
“ “	1-14-0	40.00	16.4	122.4	00.0
“ “	1-20-0	38.00	16.4	174.8	00.0
“ “	1-25-0	42.00	16.4	218.5	00.0
“ “	1-29-0	{ Min. 43.50 Max. 45.00 Av. 44.25 }	16.4	253.5	00.0
“ “	1-30-0	43.00	16.4	262.2	00.0
“ “	1¼-30-0	{ Min. 43.75 Max. 46.75 Av. 45.15 }	20.5	262.2	00.0
Mixed goods, N P	2-12-0		32.8	104.8	00.0
“ “ “ “	2½-23-0	61.50	41.0	201.0	00.0
“ “ “ “	2-16-0	39.00	32.8	139.8	00.0
Mixed goods, P K	0-14-2	36.50	00.0	122.4	33.2
“ “ “ “	0-15-2	35.00	00.0	131.1	33.2
Mixed goods, N P	3-8-0	40.00	49.2	69.9	00.0
Bone meal	3-24-0	{ Min. 44.75 Max. 47.00 Av. }	49.2	209.6	00.0
“ “	4½-24-0	52.50	73.8	209.6	00.0
Acid phosphate, K	0-16-0	{ Min. 25.00 Max. 29.00 Av. 27.61 }	00.0	139.8	00.0

The figures in the column "formula" of Table III show percents of ammonia, phosphoric acid, and potash, respectively. Thus a fertilizer having the formula, "1-12-1," contains 1 percent ammonia, 12 percent phosphoric acid, and 1 percent potash. Rules for converting these percents into the equivalent percents of nitrogen, phosphorus, and potassium are given on page 2.

"Unit" is a term common in connection with fertilizer trade. A "unit" means 1 percent of the compound referred to and is thus equivalent to 20 pounds per ton. A fertilizer with the formula, "1-12-2," contains in one ton, one unit of ammonia, twelve units of phosphoric acid, and one unit of potash, or 20 pounds of ammonia, 240 pounds of phosphoric acid, and 20 pounds of potash. In terms of the elements, one unit of ammonia is equivalent to 16.4 pounds of nitrogen, one unit of phosphoric acid is equivalent to 8.74 pounds of phosphorus, and one unit of potash is equivalent to 16.6 pounds of potassium.

These equivalents were used in calculating the pounds of plant food per ton given in Table III. In making these calculations, the figures for the guaranteed analysis were used. In some cases the prices were somewhat lower in the fall than the prices of the same class of brands in the spring, the reduction falling mainly on potassium, but somewhat on nitrogen. There was not much change in the price of phosphorus.

Sometimes the farmer can make more economical purchases of fertilizers by a careful selection of brands. This selection should be made with reference to the amount of plant food in the fertilizers, and the kind of plant food needed by the soil or crop. The figures in Table III furnish material for such comparisons and calculations.

Acid phosphate carries only one element, phosphorus. The amount of phosphorus in available form in acid phosphate is so large that this alone is figured in the guarantee. Acid phosphate contains 16 units of phosphoric acid, equivalent to 140 pounds of phosphorus per ton. At \$28 per ton, average fall price, this amounts to \$1.75 per unit, or 20 cents per pound of phosphorus.

Nitrogen was rated at \$7 per unit of ammonia in the fall, making the price per pound of nitrogen a little more than 42½ cents per pound.

Potassium was rated at \$3 per unit of potash in the fall. This is equivalent to a little more than 18 cents per pound of potassium.

The average fall price for bone meal of the formula 1¼-30-0 was \$45.15 per ton. The nitrogen in this bone meal at 42½ cents per pound would be worth \$8.75. Subtracting this from \$44.75, the lowest price of bone meal obtained from several dealers, the cost of the phosphorus in this bone meal is \$36. That is, 30 units of phosphoric acid cost \$36, or one unit cost \$1.20, a little less than 14 cents per pound for phosphorus.

These values, namely, (1) ammonia, \$7 per unit or 42½ cents per pound of nitrogen, (2) phosphoric acid, \$1.75 per unit or 20 cents per pound of phosphorus in acid phosphates and \$1.20 per unit or 14 cents per pound of phosphorus in bone meal, and (3) potash, \$3 per unit or 18 cents per pound of potassium, are used in Table IV in calculating the prices of various commercial fertilizers and comparing these with the average of the selling prices as quoted by dealers in the fall of 1919.

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TABLE IV.—COMPARISON OF AVERAGE SELLING PRICE AND CALCULATED PRICE IN DIFFERENT FERTILIZERS, FALL, 1919

FORMULA	Av. selling price	Calculated price	Difference
Mixed goods, N P K			
1-8-1	\$30 00	\$24 00	\$6 00
1-12-1	34 83	31 00	3 83
2-8-2	40 00	34 00	6 00
2-10-1	42 00	34 50	7 50
2-10-2	41 58	37 50	4 08
2-12-1	39 00	38 00	1 00
2-12-2	43 50	41 00	2 50
Mixed goods, N P			
1-10-0	34 50	24 50	10 00
8-8-0	40 00	35 00	5 00
Mixed goods, P K			
0-14-2	36 50	30 50	6 00
0-15-2	35 00	32 25	2 75
Bone meal			
1½-30	45 15	44 75	.35
1-23	41 87	34 60	7 27
1-29	44 25	41 80	2 45
1-30	43 00	43 00	.....
3-24	46 00	49 80	3 80
Acid phosphate, P			
0-16-0	27 21	28 00	.79

It is seen from these comparisons that the differences between the calculated price and the selling price is greatest in the mixed goods as a class. It was assumed that the phosphorus in mixed goods was given the same valuation as in acid phosphate. In most mixed fertilizers the source of phosphorus is acid phosphate, but it is not necessarily so. If in the above comparison, the valuation given phosphorus in mixed fertilizers had been the cost of phosphorus obtained in bone meal (14 cents per pound), the differences between the selling price and the calculated value would have been made greater.

From the foregoing tables and figures the value of any fertilizer can be readily computed. For example:

No. 1
 ARMOUR'S 1-12-1 FERTILIZER

(See page 8)

N, 0.82 percent, or 16.4 pounds per ton, @ 42½ cents per pound,	\$6.97
P, 5.24 percent, or 104.8 pounds per ton, @ 20 cents per pound,	20.96
K, 0.83 percent, or 16.6 pounds per ton, @ 18 cents per pound,	2.99
Total value per ton.....	\$30.92

No. 2
 SWIFT'S SPECIAL GRAIN FERTILIZER, 2-10-2

(See page 11)

N, 1.65 percent, or 33 pounds per ton, @ 42½ cents per pound,	\$14.03
P, 4.37 percent, or 87.4 pounds per ton, @ 20 cents per pound,	17.48
K, 1.66 percent, or 33.2 pounds per ton, @ 18 cents per pound,	5.98
Total value per ton.....	\$37.49

Both these fertilizers contain the same total units of plant food and would be classed as high-grade. In No. 2 the consumer gets 16.6 pounds more nitrogen, 16.6 pounds more potassium, but 17.4 pounds less phosphorus. At 20 cents per pound, this phosphorus is worth \$3.48. This means that the 16.6 pounds of nitrogen and 16.6 pounds of potassium cost the farmer \$10.05.

NO. 2
INTERSTATE 2-12-2 FERTILIZER

(See page 9)

N, 1.65 percent, or 33 pounds per ton, @ 42½ cents per pound, \$14.03
 P, 5.24 percent, or 104.8 pounds per ton, @ 20 cents per pound, 20.96
 K, 1.66 percent, or 33.2 pounds per ton, @ 18 cents per pound, 5.98

Total value per ton..... \$40.97

No. 3 has the same amount of phosphorus as No. 1, but has 16.6 pounds more nitrogen and 16.6 pounds more potash. This additional nitrogen and potash again, however, cost the farmer \$10.05.

This comparative calculation of the costs of nitrogen and potassium emphasizes the value of barnyard manures. One ton of average barnyard manure contains 10 pounds of nitrogen, 2 pounds of phosphorus, and 8 pounds of potassium. If a farmer needs a fertilizer higher in nitrogen and potassium and for that reason selects "2-12-2" instead of "1-12-1," he pays about \$10 more per ton, according to the above calculation. In reality the difference would probably be about \$9 per ton, as the cost of labor and shipping for one fertilizer is about the same as that of another. In two tons of barnyard manure he would have more than this extra amount of nitrogen and potassium, and in addition a little phosphorus. Besides this he would have what is of still greater importance, the humus value of the manure.

BRANDS OF FERTILIZERS REGISTERED IN KANSAS

The Kansas Fertilizer Law requires the publication of a list of the fertilizers registered and their guaranteed composition. The list given in Table V includes all registered to December 31, 1919. A list of Kansas dealers in fertilizers in 1919 and a financial statement covering the period July 1, 1918, to June 30, 1919, are included also in the following pages.

**TABLE V.—Brands of Fertilizers Registered
in Kansas**

(Pages 26 to 31, inclusive)

(25)

TABLE V.—BRANDS OF FERTILIZERS REGISTERED IN KANSAS

NAME OF BRAND	Date of Registration		Percent nitrogen	Percent phosphorus in phosphates				Percent potassium soluble in water	Percent chlorine
	Mo.	Yr.		Soluble in water	Available or reverted	Insoluble	Total		
Armour Packing Company									
Helmet Brand Raw Bone Meal	10	'07	3.71		2.18	8.30	10.48	0.00	0.00
Helmet Brand Lawn & Garden Fer	10	'07	2.88		3.49		3.49	3.32	
Helmet Brand Fine Ground Beef Bone	10	'07	2.47		2.62	7.86	10.48	.00	.00
Helmet Brand No. 282 Fer	10	'08	1.65		3.49		3.49	1.66	1.65
Helmet Brand Special Potato Fer	10	'08	1.65		3.49		3.49	3.30	.00
Helmet Brand Ammoniated Dissolved Bone and Potash	10	'08	1.65		4.37		4.37	1.66	
Helmet Phosphate and Potash	8	'12			4.37	.22		1.66	
Helmet No. 184	8	'12	.82		3.49	.22		3.32	
Helmet 16 Percent Phosphate	4	'14			6.99	.22	7.21		.25
Armour's 1-8-1 Fer	3	'15	.82		3.49	.22	3.71	.83	1.00
Armour's 1-12-1 Fer	3	'15	.82		5.24	.22	5.46	.83	1.00
Armour's 12-2 Fer	3	'15			5.24	.22	5.46	1.66	
Armour's Special Grain Grower	3	'16	1.65		3.49	.22	3.71	.83	2.00
Armour's New Record Brand	3	'16	.82		4.47	.22	4.59	.83	1.00
Armour's Ammoniated Phosphate	3	'16	1.65		4.37	.22	4.59	.00	1.00
Armour's Phosphate and Potash Special	4	'17			4.37	.22		.83	
Armour's 1-10-0 Fer	1	'19	.82		4.37	.22	4.59	0.00	.50
Armour's Big Crop 2-12 Fer	12	'19	1.65		5.24	.22	5.46	.00	
Armour's Big Crop 12-2 Fer	12	'19	.00		5.24	.22	5.46	1.66	2.00
Armour's Big Crop 12-4 Fer	12	'19	.00		5.24	.22	5.46	3.32	4.00
Armour's 2-12-2 Brand	12	'19	1.65		5.24	.22	5.46	1.66	2.00
Armour's Big Crop 2-10-4 Fer	12	'19	1.65		4.37	.22	4.59	3.32	4.00
Armour's 16 Percent Acid Phosphate	12	'19	.00		6.99	.22	7.21	.00	.25
Armour's 1-12-1 Fer	12	'19	.82		5.24	.22	5.46	.83	1.00
Armour's Big Crop Bone Meal	12	'19	2.46				10.50	.25	
American Reduction and Fertilizer Company									
Kaw Special	1	'09	1.65	.66	.30	.79	1.75	4.00	2.50
Kaw Wheat & Small Grain Grower	8	'09	1.65	2.00	1.50	.85	4.35	1.66	2.00
Kaw Special Potash Mixture	8	'09	.41	1.00	.75	.42	2.17	5.00	2.50
Kaw Raw Bone Meal and Manure Potash	2	'13	1.64	.87		.48	5.67	2.49	1.20
American Agricultural Chemical Company									
Empire Raw Bone Meal	9	'09	3.29				9.61		
Empire Special Bone Meal	9	'09	1.23				10.91		
Empire Potato and Truck Special	3	'11	.82	2.13	1.36	.87	4.36	5.81	5.26
Empire Crop Grower	3	'12	1.65	2.50	1.00	.50	4.00	1.66	2.00

2-8-6 Fertilizer.....	8	'12	1.65		3.49	.87	4.37	4.15	
Empire Bone Black Fertilizer.....	9	'09	2.05		3.49	.87	4.63	1.25	
Empire Pure Raw Bone Meal.....	4	'11	3.29				8.73		
Empire Better Than Bone.....	3	'15	2.47		3.49	.87	4.37	2.49	
Empire Heavycrop.....	3	'15	1.65		3.49	.87	4.37	2.49	
Empire Farmers Favorite.....	6	'15	.82		4.87	.22	4.59	.83	
Empire Middle West Grain Grower.....	6	'15	1.65		4.80	.22	5.02	.83	
Empire 16 Percent Phosphate.....	3	'15			6.98	1.74	8.72		
Bone Black Fertilizer.....	2	'16	2.06		3.49	.27	3.76	.83	
Steam Bone Substitute.....	2	'16	1.65		4.86	.27	4.63		
Bone Black Fertilizer No. 2.....	2	'16	2.06		3.49	.27	3.76		
Empire Middle West Grain Grower.....	1	'17	1.65		4.87	.22	4.59	.83	
Empire Economy Mixture, 3.....	7	'18	.82		4.37	.22	4.59		
Cochrane Packing Company									
Cochrane's Champion Grain Grower.....	8	'16	1.65		4.37	.22	4.59	.83	
Cochrane's Pure Bone Meal.....	8	'16	2.47		2.62	7.86	10.48		
Cochrane's Special Grain Producer.....	8	'16	.82		5.24	.22	5.46	.83	
Cochrane's Wheat, Oats & Corn Maker.....	8	'16	1.65		5.24	.22	5.46	.83	
Cochrane's Corn and Wheat Grower.....	1	'18	1.03	2.99	2.49	.50	3.98	1.03	
Cochrane's Special Pure Bone Meal Tankage & Potash..	1	'18	1.25	.80	1.30	8.90	6.00	.83	1.30
Cochrane's Pulverized Sheep Guano.....	2	'18	1.65		.87	.44	1.31	.83	
Continental Fertilizer Company									
Grain and Grass Grower.....	8	'14	1.65		3.49	.22	3.71	1.66	
Bone Meal.....	8	'14	2.46				10.50		
Raw Bone Meal.....	8	'14	3.70				9.65		
Standard Fertilizer.....	8	'14	1.65		4.37	.22	4.59	1.66	
Phosphate and Potash.....	3	'15			5.24	.22	5.46	1.66	
1-12-1 Fertilizer.....	3	'15	.82		5.24	.22	5.46	.83	
1-8-1 Fertilizer.....	3	'15	.82		3.49	.22	3.71	.83	
Bear Brand Acid Phosphate.....	7	'16			6.99	.22	7.21		
Cudahy Packing Company									
Ground Cattle Tankage.....	4	'11	5.35	2.10		3.89	5.99		
Cudahy's Blue Ribbon Steamed Bone Meal..	10	'18	2.47				10.48		
Fertile Chemical Company									
Nitro-Fertile.....	10	'18	2.00	3.00			3.00	2.60	
Lime-Fertile.....	12	'19				3.00	3.00		
Flower City Plant Food Company									
Walker's Excelsior Plant Food.....	8	'19	5.00	7.00				3.00	
P. C. Floyd									
Floyd's 16 Percent Acid Phosphate.....	10	'19		7.00		.33	7.33		

TABLE V.—CONTINUED

NAME OF BRAND	Date of Registration		Percent nitrogen	Percent phosphorus in phosphates				Percent potassium soluble in water	Percent chlorine
	Mo.	Yr.		Soluble in water	Available or reverted	Insoluble	Total		
German Kali Works									
Sulfate of Potash.....	11	'10						40.00	1.00
Murate of Potash.....	11	'10						41.00	50.00
Kanit.....	11	'10						10.00	40.00
Hirsh Stein and Company									
Calumet Brand Pure Raw Bone Meal.....	8	'11	3.70				8.73		
Calumet Brand Special Pure Bone Meal and Potash.....	2	'18					8.73	3.32	9.50
Hull and Dillon Packing Company									
Enterprise Brand.....	10	'07	6.74		2.95	1.07	4.02	.44	
Interstate Fertilizer Company									
Steam Bone Meal, 1-29.....	7	'19	.82		3.17	9.49	12.66	.00	.00
Interstate 2-12-0.....	7	'19	1.65		5.24	.22	5.46	.00	.00
Interstate 1-12-1.....	7	'19	.82		5.24	.22	5.46	.83	1.00
Interstate Raw Bone Mixture 2-16-0.....	7	'19	1.65		3.49	3.49	6.98	.00	1.00
Interstate Raw Bone Potash.....	7	'19	1.65		3.49	3.49	6.98	.83	1.00
Interstate 16 Percent Acid Phosphate.....	7	'19			6.99	.22	7.21		
Interstate 2-12-2.....	6	'19	1.65		5.24	.22	5.46	1.66	1.00
Kansas City Feed and Fertilizer Company									
Available Bone Phosphate.....	9	'19	.75		11.8	.7	12.5		1.00
Leavenworth Desiccating Works									
Sunflower Fertilizer.....	2	'18	7.15				5.60		
Meridian Fertilizer Factory									
Southern Acid Phosphate.....	9	'18		5.10	1.02				
Meridian Kansas Special.....	9	'18	.82	4.37	.87			.83	
Meridian Wheat Grower.....	7	'19	1.65	4.37	.87	.16	5.40		
Meridian Western Special.....	7	'19	1.65	4.37	.87	.16	5.40		.83
Union Special Acid Phosphate.....	8	'19		5.68	1.31	.22		7.21	
Meridian Great Western.....	9	'19	1.65	4.37	.87	.16	4.50	1.66	
Meridian Grain Grower.....	9	'19	1.65	3.64	.72	.14	4.50	1.66	

Morris & Company									
Steamed Bone Meal...	9	'14	.82				13.97		
3 x 28 Bone Meal...	9	'15	2.46				12.22		
Special Big Four.....	9	'19	.41		5.68	2.18	7.86		
National Plant Food Company									
"Red Snapper".....	11	'18	5.00	4.00		8.00	12.00	1.25	
Union Seed and Fertilizer Company									
Farmers Cornucopia.....	4	'10	2.47	10.00	2.00	2.00	14.00	2.00	3.00
The Pulverized Manure Company									
Wizard Brand Phosphated Manure	1	'18	.82	.20	3.59		3.79	1.00	
Thomas Ruddy and Company									
Ruddy's Corn and Wheat Special, 1-12-1 ..	8	'18	.82		5.24	.20	5.44	.83	1.50
Ruddy's 2-10-1/4 Fertilizer	8	'18	1.65		4.37	.20	4.57	.49	.50
Ruddy's 1-8-1 Fertilizer	8	'18	.82		3.49	.22	3.71	.83	
Ruddy's Ammoniated Bone Fertilizer, 1-23	8	'18			4.25	3.75	10.00		
Ruddy's Standard Grain Grower 1-10-1.....	8	'18	.82		4.37	.22	4.59	.83	1.50
Ruddy's Acid Phosphate.....	8	'19			6.99	.22	7.21		
Ruddy's Top Dressing 2-10-0.....	12	'18	1.65		4.37	.20	4.57		.50
Ruddy's 1 1/2-30-0 Bone Fer	8	'19	1.02				13.11		
Ruddy's Steamed Bone Fer. 3-24	8	'18	2.47		2.62	7.86	10.48		
Southern Cottonoll Company									
Skoko Wheat Special.....	7	'18	1.65	13.00					
Skoko Acid Phosphate.....	7	'18		7.00					
Skoko Special Mixture.....	8	'18	.82	3.50				.93	.63
The Stanton and Lindburg Packing Company									
Stanton and Lindburg Fer	6	'08	7.84	.46	4.26	49	5.21	1.57	.03
Virginia-Carolina Chemical Company									
V. C. Superphosphate	6	'18		6.37	.72	.42	7.52		.28
V. C. Grain Grower	7	'19		4.20	1.04	.76	6.00	1.66	.70
Champion Corn and Wheat Grower.....	6	'18	.86	3.63	.74	.67	4.99	.93	.63
Crescent Wheat Grower	6	'18	1.65	4.20	1.04	.76	6.01		.35
Monarch Grain Grower.....	8	'19		5.25	1.30	.95	7.50	1.66	.70
Bone Meal Mixture	8	'19	3.30				8.80		
Swift and Company									
Swift's Strawberry Special Fer	12	'07	3.29		4.80	.44	5.24	8.30	
Swift's Pure Raw Bone Meal	12	'07	3.70				10.04		
Swift's Vegetable Grower	4	'09	3.29		4.80	.44	5.24	8.30	
Swift's Superphosphate	3	'13	1.65		3.49	.44	3.93	1.66	1.51
Swift's Special Grain Fer	3	'13	1.65		4.37	.43	4.80	1.66	1.51
Swift' Pure Bone Meal	3	'13	2.47				10.48		

TABLE V.—CONCLUDED

NAME OF BRAND	Date of Registration		Percent nitrogen	Percent phosphorus in phosphates				Percent potassium soluble in water	Percent chlorine
	Mo.	Yr.		Soluble in water	Available or reverted	Insoluble	Total		
Swift and Company—concluded									
Swift's Onion, Potato, and Tobacco Fer.	3	'18	1.65		3.49	.44	3.93	5.81	.....
Swift's No. 4 Manure Mixture	6	'16	1.64				6.99	.62	2.50
Swift's Special Bone Meal and Potash	4	'18	.82				7.85	3.32	3.02
Swift's Special Bone Meal	4	'18	.82				12.66		
Swift's No. 3 Manure Mixture	2	'18	1.65	1.00			4.36	1.66	1.51
Swift's No. 2 Manure Mixture	4	'18	2.26				3.49	4.15	.....
Swift's Diamond "B" Fer	4	'14	2.47	2.42			3.98	4.15	4.91
Swift's Champion Wheat and Corn Grower	4	'14	1.65				5.46	1.66	1.88
Swift's Wheat, Corn and Oats Special 1-11-4	5	'14	.82				5.24	3.32	3.88
Swift's High Grade Acid Phosphate	4	'18					4.80		
Swift's Diamond "N" Grain Grower	1	'15	1.65				6.99		
Swift's Diamond "M" Grain Grower	1	'15	1.65				3.93	.83	1.08
Swift's Diamond "L" Grain Grower	1	'15	1.65				4.80	.83	1.56
Swift's Clay Soil Special	1	'15	1.65				5.24	.83	1.28
Swift's Diamond "A" Vegetable and Fruit Grower	1	'15	2.47				5.46		.43
Swift's Ground Beef Bone	3	'16	2.05				3.93		.56
Swift's Ground Steam Bone	5	'16	1.64				11.80		
Swift's Trick Fertilizer	5	'16	2.47				8.74		
Swift's Tomato & Vegetable Fer.	5	'16	.82				3.93	.83	1.50
Swift's Diamond "K" Grain Grower	5	'16	.82				3.49	.44	1.50
Swift's Bone Meal and Phosphate	5	'16	1.65				5.24	.22	5.46
Swift's Ammoniated Bone Phosphate and Potash	7	'16	1.65				4.37	.43	4.80
Swift's Special Grain and Grass Grower	3	'18	.82				4.37	.43	4.80
Swift's Complete Fertilizer	3	'18	1.23				3.49	.44	3.93
Swift's 1 1/2-30 Bone Meal Fertilizer	3	'18	2.47				18.11		
Swift's Top Dressing Fertilizer	8	'18	1.03				3.93		.56
Swift's 1 1/2-30 Bone Meal Fertilizer	7	'19					13.11		
Swift's 0-14-2 Fertilizer	1	'15	2.47				6.11	.44	6.55
Swift's Hay and Silage Grower							3.49	.44	3.67
Sulzberger and Sons Company									
Sulzberger's Pure Bone Meal	8	'12	2.47				5.00	5.85	10.85
Sulzberger's Pure Raw Bone Meal	3	'14	1.23				2.20	7.80	10.00
S & S Special Bone Meal	3	'14	1.23						12.23
S & S Raw Bone Meal and Plant Potash	5	'14	1.65						6.12

S & S Bone Grain Grower.....	3	'16	1 65				4 37	.88	
S & S Corn and Oat Grower.....	5	'16	.82	1.42	2.50		4.80	.88	
S & S Corn and Wheat Special...	3	'16	1.65	8.50		.87	4.37	.88	
Wilson and Company									
Wilson's Special Bone Meal.....	8	'16	.82				18 00		
Wilson's Raw Bone Meal and Plant Potash.....	8	'16	1.65				6.12	.88	
Wilson's Corn and Wheat Special..	8	'16	1.65	3.50		.87	4.37	.88	
Wilson's Bone Grain Grower.....	8	'16	1.65				4.37	.88	
Wilson's "Two Ten" Fertilizer.....	6	'17	1.65		2.34	.78	5.24		
Wilson's Special Grain Fertilizer.....	6	'17	.82	1.90	1.67	.80	4.37	.88	
Wilson's Kali-Phosphate.....	6	'17		2.85	2.47	.80	6.12	.88	
Wilson's Bone Meal Acid Phosphate.....	6	'17	.82	2.25	4.00	3.75	10.00		
Wilson's Bone Meal.....	6	'17		2.47			10.47		
Wilson's Corn and Wheat Special..	4	'19	1.65	3.50		.87	4.37	1.66	
Wilson's Red "W" Grain Grower..	8	'19	.82	8.50	1.74	.26	5.50	.88	

LIST OF KANSAS DEALERS IN FERTILIZERS, 1919

PLACE	DEALER	MANUFACTURER
Altamont	Libby Brothers	Swift & Co.
Altamont	L. B. VanSlyke	Armour & Co.
Altamont	Libby Brothers	Interstate Fertilizer Company
Altoona	Wilmoth & Lloyd	Cudahy Packing Company
Altoona	Bail & Hamilton	Swift & Co.
Americus	Haynes Hardware Company	Swift & Co.
Amiot	C. L. Richardson	Armour & Co.
Angola	E. A. McCartney	Swift & Co.
Arcadia	Denton Hardware Company	Swift & Co.
Atchison	Atchison Seed and Flower Company	Swift & Co.
Axtell	Farmers Union Coop. Assn.	Swift & Co.
Baldwin	Douglas County Farmers Assn.	Swift & Co.
Baldwin	Williams & Brown	Thomas Ruddy Company
Bartlett	E. E. Bickford	Swift & Co.
Baxter Springs	Ed. Gaines	Swift & Co.
Baxter Springs	E. B. Davis	Swift & Co.
Baxter Springs	Jaqueth & Gillman	Cudahy Packing Company
Baxter Springs	Chas. D. Thomas	Interstate Fertilizer Company
Baxter Springs	Jaqueth & Gillman	Armour & Co.
Baxter Springs	Stauffer-Cammack	Virginia-Carolina Chemical Company
Beulah	J. E. Durk	Virginia-Carolina Chemical Company
Blue Mound	H. B. Smith	Swift & Co.
Bonner Springs	Oscar Hyoort	American Agr. Chemical Company
Brazilton	A. J. Haden	Armour & Co.
Brazilton	A. F. LaForg	Thomas Ruddy Company
Brazilton	C. H. Ryan	Armour & Co.
Brazilton	Crawford County Union	Swift & Co.
Bronson	Bronson Grain Company	Swift & Co.
Bronson	Noble Grain Company	Swift & Co.
Bucyrus	Chas. Hefebower	Cochrane Packing Company
Bucyrus	Bucyrus Farmers Coop. Assn.	Swift & Co.
Buffalo	Woodson County Grain Company	Armour & Co.
Burlingame	Rogers & Morganroth	Armour & Co.
Burlingame	E. G. Spaulding	Swift & Co.
Burlingame	Carl Jacoby	Armour & Co.
Burlington	Burlington Hardware Company	Cudahy Packing Company
Burlington	Farmers Produce Company	Armour & Co.
Burlington	D. O. Giford	Swift & Co.
Cairo	Dave Mahaffy	Swift & Co.
Caney	J. M. Mason	Swift & Co.
Cedar Vale	Cedar Vale Mercantile Company	Swift & Co.
Chanute	W. B. Young & Co.	Swift & Co.
Chanute	Robert Griffin	Thomas Ruddy Company
Chanute	C. D. Resler	Armour & Co.
Cherryvale	Cherryvale Grain Company	Swift & Co.
Cherryvale	Clayton Supply Company	American Agr. Chemical Company
Cherryvale	Edgar Zinc Company	American Agr. Chemical Company
Chetopa	J. F. Shields	Swift & Co.
Chetopa	Chetopa Grain Company	Armour & Co.
Chetopa	E. E. Bickford	Swift & Co.
Chiles	R. R. Crawford	Swift & Co.
Coffeyville	Allin Grain Company	Swift & Co.
Colony	L. Crosby & Son	Thomas Ruddy Company
Colony	H. R. Rhodes	Thomas Ruddy Company
Colony	Colony Elevator Company	Armour & Co.
Colony	A. F. Huskey	Swift & Co.
Columbus	E. B. Davis	Thomas Ruddy Company
Columbus	Cherokee County Mill and Elevator Company,	Wilson & Co.
Columbus	Cherokee County Mill and Elevator Company,	Armour & Co.
Columbus	Cherokee County Mill and Elevator Company,	Interstate Fertilizer Company
Columbus	E. B. Davis	Swift & Co.
Columbus	G. W. Crow	Cudahy Packing Company
Concordia	Robinson & McCrary	Armour & Co.
Conway Springs	C. C. Smith	Swift & Co.
Conway Springs	C. C. Smith	Fertile Chemical Company
Corning	Corning Elevator Company	Swift & Co.
Crestline	H. L. Jaqueth & Co.	Armour & Co.
Crestline	E. B. Davis	Swift & Co.
Cummings	E. D. Rather	Swift & Co.

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PLACE	DEALER	MANUFACTURER
De Soto	R. C. Jackman	Thomas Ruddy Company
De Soto	Gordon Grain Company	Swift & Co.
Earleton	Henry Greve	Armour & Co.
Earleton	E. A. George	Cudahy Packing Company
Earleton	Henry Greve	Cudahy Packing Company
Earleton	E. A. George	Swift & Co.
Edgerton	Ben Brecheisen	Cochrane Packing Company
Edgerton	W. H. Kelly	Swift & Co.
Edna	Wilmoth Grain Company	Swift & Co.
Edna	Farmers Coop. Supply Company	Armour & Co.
Edna	Rae Patterson Milling Company	Swift & Co.
Edwardsville	J. W. Taylor	Armour & Co.
Elk City	J. H. Meyer	Cudahy Packing Company
Elk Falls	Findlay & Frakes	Swift & Co.
Elsmore	Kokstrom Brothers	Armour & Co.
Elsmore	Price & Cox	Swift & Co.
Emporia	Haynes Hardware Company	Swift & Co.
Emporia	Alfalfa Milling Company	Cudahy Packing Company
Emporia	U. S. Wolf	Armour & Co.
Emporia	Henry Lynn	Thomas Ruddy Company
Englevale	Karns Coal and Mercantile Company	Swift & Co.
Erie	Johnson & Son	Swift & Co.
Erie	Erie Farmers Union Coop. Assn.	Armour & Co.
Eureka	A. D. Burt & Co.	Swift & Co.
Eudora	E. W. Kraus	Swift & Co.
Farlington	Crawford County Union	Armour & Co.
Farlington	Crawford County Union	Swift & Co.
Farlington	Wood Brothers	Armour & Co.
Faulkner	E. B. Davis	Swift & Co.
Faulkner	P. B. White & Co.	Virginia-Carolina Chemical Company
Faulkner	J. M. Forbes	Armour & Co.
Fontana	Blaker Lumber Company	Swift & Co.
Fort Scott	Mead Grain Company	Swift & Co.
Fort Scott	Fort Scott Grain and Implement Company	American Agr. Chemical Company
Fort Scott	Mead Grain Company	Armour & Co.
Frankfort	G. E. Gano	Swift & Co.
Fredonia	Wiley Milling Company	Swift & Co.
Fredonia	Earl Gibson	Armour & Co.
Fredonia	Shannon Implement Company	Armour & Co.
Fredonia	The Grange Store	Cudahy Packing Company
Fredonia	Shannon Implement Company	Swift & Co.
Galena	H. L. Jaqueth	Armour & Co.
Galesburg	J. M. Shaw	Swift & Co.
Galesburg	Carl Brunenn	Thomas Ruddy Company
Gardner	J. F. Rankin	Armour & Co.
Gardner	The Blacker Grain Company	Cudahy Packing Company
Gardner	Gordon Grain Company	Swift & Co.
Garnett	Frank Foltz	Armour & Co.
Garnett	F. S. Turner	Cudahy Packing Company
Garnett	Frank Foltz	Swift & Co.
Girard	Crawford County Union	Swift & Co.
Goff	Trader Mercantile Company	Swift & Co.
Gridley	Olson & Bahr	Swift & Co.
Hackney	Col. Warn. Russel.	Swift & Co.
Hallowell	E. B. Davis	Swift & Co.
Hallowell	J. M. Forbes	Armour & Co.
Hallowell	Farris & Land	Armour & Co.
Hallowell	J. M. Forbes	Interstate Chemical Company
Hallowell	E. K. Gibbs	Armour & Co.
Harris	J. F. Turrell	Swift & Co.
Hartford	R. D. Carpenter & Co.	Thomas Ruddy Company
Hartford	O'Connor & Stratton	Swift & Co.
Harveyville	J. H. Dongan	Swift & Co.
Hepler	G. T. Cornell	American Agr. Chemical Company
Hepler	Chas M. Orr	Swift & Co.
Hiattville	Williams Hardware	Swift & Co.
Hoag Switch	E. B. Davis	Swift & Co.
Holton	Bernard Brothers	Swift & Co.
Howe Station	J. L. Taylor	Swift & Co.
Hoyt	T. F. Waters	Swift & Co.

PLACE	DEALER	MANUFACTURER
Humboldt	Stewart Bragg Hardware Company	Swift & Co.
Humboldt	Dickinson Brothers Grain and Hay Company,	Armour & Co.
Humboldt	Grange Supply House	Thomas Ruddy Company
Humboldt	J. Frank Stephens	Thomas Ruddy Company
Humboldt	E. H. Leitzbach	Armour & Co.
Humboldt	F. C. Miller	Armour & Co.
Humboldt	L. F. Buenger	Armour & Co.
Hutchinson	Young & Sons	Swift & Co.
Idenbro	Farmers Coop. Assn.	Swift & Co.
Independence	Union Implement Company	Swift & Co.
Iola	Graf & Anderson	Swift & Co.
Iola	Iola Mill and Elevator Company	American Agr. Chemical Company
Kimball	Milner Beck Company	Armour & Co.
Kincaid	Hensley & Brosius	Cudahy Packing Company
Kincaid	Hensley & Brosius	Swift & Co.
Kingman	J. E. Ferguson	Fertile Chemical Company
Labette	Labette Mercantile Company	Swift & Co.
Labette	Labette Grange 1656	Thomas Ruddy Company
La Cygne	C. T. Potter	Swift & Co.
La Cygne	J. L. Teagarden	Armour & Co.
La Cygne	W. J. Dyer Elevator Company	Cudahy Packing Company
La Harpe	C. L. Wilson & Son	Cudahy Packing Company
La Harpe	Hackney & Son	Armour & Co.
La Harpe	C. L. Wilson & Son	Swift & Co.
Lang	Henry Lynn	Thomas Ruddy Company
Lansing	W. B. Young	Swift & Co.
Lawrence	Barteldes Seed Company	Swift & Co.
Lawrence	J. Underwood & Son	American Agr. Chemical Company
Lawrence	R. C. Jackman	Thomas Ruddy Company
Leavenworth	Reyburn Hardware Company	Swift & Co.
Liberty	J. M. Mason	Swift & Co.
Linwood	Linwood Elevator Company	Swift & Co.
Linwood	Theo. Meinke	Swift & Co.
Linwood	C. C. Hemphill	Armour & Co.
Lone Elm	M. Carrier Estate	Swift & Co.
Louisburg	W. A. Stephenson	Cudahy Packing Company
Louisburg	J. W. Brullman	Swift & Co.
Louisburg	Interstate Mercantile Company	Thomas Ruddy Company
Lyndon	F. E. Michaels	Thomas Ruddy Company
Lyndon	Fred Anstaett	Swift & Co.
McCune	G. F. Samp	American Agr. Chemical Company
McCune	M. L. Westervelt	American Agr. Chemical Company
McCune	McCaslin & Son	Swift & Co.
McCune	Crawford County Union	Swift & Co.
McFarland	August T. Hansen	Swift & Co.
McPherson	McPherson Seed and Produce Company	Cudahy Packing Company
Madison	W. O. Waymore	Swift & Co.
Manhattan	Kansas State Agricultural College	Swift & Co.
Manhattan	Geo. T. Fielding's Sons	Swift & Co.
Military	H. L. Jaqueth & Co.	Armour & Co.
Military	E. B. Davis	Swift & Co.
Moline	E. R. Walker	Swift & Co.
Monmouth	Joe Terfinger	American Agr. Chemical Company
Moran	Moran Grain Company	Swift & Co.
Moran	Moran Grain Company	Armour & Co.
Moran	Moran Grain Company	Thomas Ruddy Company
Morganville	Farmers Coop. Elevator Assn.	Armour & Co.
Mound City	Gleason & Son	Cudahy Packing Company
Mound Valley	Call Brothers	Swift & Co.
Mound Valley	O. W. Bortorff	Armour & Co.
Neodesha	S. D. Logan	Swift & Co.
Neosho Falls	Neosho Falls Lumber Company	Swift & Co.
Netawaka	J. M. Green	Swift & Co.
Neutral	Chas. D. Thomas	Interstate Fertilizer Company
Neutral	T. P. Bumgarner	American Agr. Chemical Company
Neutral	E. B. Davis	Swift & Co.
Northcott	W. S. Bozeman	Swift & Co.
Nortonville	J. J. Speck	Swift & Co.
Nortonville	J. J. Speck	Armour & Co.

REPORT ON COMMERCIAL FERTILIZERS

PLACE	DEALER	MANUFACTURER
Olathe	Hadley Milling Company	Swift & Co.
Olathe	Hadley Milling Company	Armour & Co.
Olathe	Willis C. Keeper	Swift & Co.
Olpe	Bradfield & Hathaway	Armour & Co.
Olpe	Bradfield & Hathaway	Swift & Co.
Oneida	C. F. Blauer	Swift & Co.
Opolis	Opolis Elevator Company	Swift & Co.
Opolis	Orlo Moore	Armour & Co.
Osage City	Asher Adams	Armour & Co.
Osawatomie	J. B. Remington	Swift & Co.
Oswego	Pearl Roller Mill Company	Armour & Co.
Oswego	E. M. Stice	Swift & Co.
Ottawa	W. S. Williams Grain Company	Swift & Co.
Oxford	L. M. Barton	Swift & Co.
Paola	Whitaker Brothers	Swift & Co.
Paola	Paola Farmers Coop. Assn.	Cudahy Packing Company
Paola	Paola Farmers Coop. Assn.	American Agr. Chemical Company
Paola	Fowler Commission Company	Swift & Co.
Parker	Wm. Hartford	Swift & Co.
Parnell	C. A. Volk	Swift & Co.
Parsons	Farmers Union Coop. Assn.	Swift & Co.
Parsons	Farmers Union Coop. Assn.	American Agr. Chemical Company
Parsons	C. S. Bailey Feed Company	Cudahy Packing Company
Parsons	C. S. Bailey Feed Company	Interstate Fertilizer Company
Parsons	A. C. Hoke	Interstate Fertilizer Company
Parsons	Farmers Union Coop. Assn.	Cochrane Packing Company
Parsons	Farmers Union Coop. Assn.	Thomas Ruddy Company
Piqua	Piqua Elevator Company	Swift & Co.
Piqua	Geo. Wille, Jr.	Swift & Co.
Piqua	J. J. Wilson Lumber Company	Swift & Co.
Pittsburg	Kelso Grain Company	American Agr. Chemical Company
Pittsburg	Kelso Grain Company	Cudahy Packing Company
Pittsburg	Pittsburg Modern Milling Company	Cudahy Packing Company
Pittsburg	Kelso Grain Company	Interstate Fertilizer Company
Pittsburg	Kelso Grain Company	Armour & Co.
Pittsburg	Pittsburg Modern Milling Company	American Agr. Chemical Company
Pittsburg	Pittsburg Modern Milling Company	Armour & Co.
Pittsburg	R. A. Tenant	Armour & Co.
Pittsburg	Kelso Grain Company	Swift & Co.
Pittsburg	Kelso Grain Company	Thomas Ruddy Company
Pittsburg	Pittsburg Elevator Company	Swift & Co.
Pleasanton	Farmers Union Store	American Agr. Chemical Company
Pleasanton	Blaker Lumber Company	Swift & Co.
Plymouth	Henry Lynn	Thomas Ruddy Company
Pomona	Wm. Bower & Son	Swift & Co.
Pontiac	Siegrist Brothers	Swift & Co.
Prescott	J. R. Newman	Swift & Co.
Quaker	E. B. Davis	Swift & Co.
Quenemo	Quenemo Commission Company	Cudahy Packing Company
Rantoul	R. C. Jackman	Thomas Ruddy Company
Redfield	Redfield Lumber Company	Cudahy Packing Company
Redfield	Redfield Lumber Company	Swift & Co.
Richmond	S. R. McRea Lumber Company	Armour & Co.
Riverton	Chas. D. Thomas	Cochrane Packing Company
Roper	J. M. Mason	Swift & Co.
Saint Paul	M. A. Muncing	Armour & Co.
Saint Paul	Farmers Coop. Elevator Company	Cudahy Packing Company
Saint Paul	Farmers Coop. Assn.	Swift & Co.
Savonburg	Kokstrom Brothers	Armour & Co.
Savonburg	Elmer White	Armour & Co.
Savonburg	W. H. Roberts	Swift & Co.
Scammon	Kelso Grain Company	Interstate Fertilizer Company
Scammon	E. B. Davis	Swift & Co.
Scranton	F. E. Michaels	Thomas Ruddy Company

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PLACE	DEALER	MANUFACTURER
Scranton	Carl Jacoby	Armour & Co.
Sedan	F. Ackerman	Swift & Co.
Seneca	Kollzer Lumber Company	Swift & Co.
Severy	P. Ludvickson	Cudahy Packing Company
Shaw	C. E. Ressler	Armour & Co.
Sherwin	E. B. Davis	Swift & Co.
Sherwin	J. M. Forbes	Armour & Co.
Sibleyville	E. W. Kraus	Swift & Co.
South Mound	Farmers Union	Swift & Co.
South Mound	J. F. Denton	Swift & Co.
Spring Hill	Spring Hill Creamery Company	Cudahy Packing Company
Stark	Milner Beck Company	Armour & Co.
Stark	Farmers Coop. Assn.	Swift & Co.
Star Valley	Labette County Farmers Union	Cochrane Packing Company
Stilwell	L. A. Medaris	Swift & Co.
Stover	R. H. Williams	Swift & Co.
Thayer	Carl Brunenn	Thomas Ruddy Company
Thayer	Thayer Grange Company	Swift & Co.
Thayer	C. L. Cross & Son	Swift & Co.
Tonganoxie	Zellner Mercantile Company	Swift & Co.
Topeka	D. O. Coe	Swift & Co.
Toronto	J. E. Rogers	Swift & Co.
Tyro	C. F. Fields	Thomas Ruddy Company
Tyro	J. Mahaffy	Swift & Co.
Udall	Harry L. Shoemaker	Swift & Co.
Udall	F. M. Latham	Swift & Co.
Uniontown	Goodlander Y Konantz	Armour & Co.
Uniontown	H. M. Griffith	Swift & Co.
Urbana	Lewis Taylor	Swift & Co.
Valley Falls	Thos. Hatfield	Swift & Co.
Vermillion	T. F. Smith	Swift & Co.
Vernon	Woodson County Grain Company	Armour & Co.
Vernon	E. B. Briles & Son	Armour & Co.
Vinland	E. W. Kraus	Swift & Co.
Walnut	Crawford County Union	Swift & Co.
Wamego	H. C. Mathies	American Agr. Chemical Company
Washington	C. Ray Kiger	Swift & Co.
Weir	H. W. Sutton	American Agr. Chemical Company
Weir	Kelso Grain Company	Interstate Fertilizer Company
Welda	R. D. Brown	Swift & Co.
Wellsville	M. C. Everett	Swift & Co.
Wellsville	Mignot & Hughes	Armour & Co.
Wellsville	C. J. Musick	Armour & Co.
West Mineral	Labette County Farmers Union	Cochrane Packing Company
West Mineral	Kelso Grain Company	Interstate Fertilizer Company
Westphalia	Farmers Elevator and Store Company	Swift & Co.
Wichita	Ross Brothers Seed Company	Armour & Co.
Wichita	Steel Hardware Company	Fertile Chemical Company
Wichita	Campbell Seed and Supply Company	Fertile Chemical Company
Wichita	Marlow Seed Company	Swift & Co.
Williamsburg	D. Fogle Mercantile Company	Swift & Co.
Winfield	McGregor Hardware Company	Fertile Chemical Company
Winfield	Silver Seed Company	Swift & Co.
Yates Center	Yates Center Mills	Swift & Co.
Yates Center	Woodson County Grain Company	Armour & Co.
Yates Center	Woodson County Grain Company	Thomas Ruddy Company

REPORT ON COMMERCIAL FERTILIZERS

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FINANCIAL STATEMENT—FERTILIZER FEES

(July 1, 1918, to June 30, 1919)

RECEIPTS

1918			
		Balance on hand July 1, 1918.....	\$8,269.89
July	6	Empire Carbon Works reg. fee.....	25.00
July	17	Cochrane Packing Company, tax tags.....	100.00
July	17	Armour & Co., tax tags.....	100.00
July	27	Armour & Co., tax tags.....	100.00
July	29	The Southern Cotton Oil Company, reg. fees.....	75.00
July	29	Empire Carbon Works, tax tags.....	250.00
Aug.	1	Armour & Co., tax tags.....	100.00
Aug.	7	Thomas Ruddy Company, tax tags.....	325.00
Aug.	7	Armour & Co., tax tags.....	100.00
Aug.	8	The Southern Cotton Oil Company, tax tags.....	25.00
Aug.	15	Swift & Co., reg. fee.....	25.00
Aug.	18	Thomas Ruddy Company, tax tags.....	25.00
Aug.	27	Virginia-Carolina Chemical Company, tax tags.....	125.00
Aug.	28	Thomas Ruddy Company, reg. fees.....	200.00
Aug.	29	Armour & Co., tax tags.....	100.00
Aug.	29	Morris & Co., reg. fee.....	25.00
Sept.	9	Swift & Co., tax tags.....	500.00
Sept.	24	Meridian Fertilizer Company, tax tags.....	194.00
Oct.	8	Swift & Co., tax tags.....	250.00
Oct.	9	Thomas Ruddy Company, tax tags.....	125.00
Oct.	15	Cudahy Packing Company, reg. fee.....	25.00
Oct.	22	Pulverized Manure Company, tax tags.....	12.50
Oct.	22	Fertile Chemical Company, reg. fee.....	25.00
Oct.	31	Fertile Chemical Company, tax tags.....	12.50
Nov.	27	Cudahy Packing Company, tax tags.....	150.00
Nov.	27	Swift & Co., tax tags.....	250.00
Dec.	21	Cudahy Packing Company, tax tags.....	150.00
1919			
Jan.	6	Morris & Co., tax tags.....	25.00
Jan.	11	Armour & Co., tax tags.....	100.00
Jan.	11	National Plant Food Company, reg. fee.....	25.00
Jan.	17	Fertile Chemical Company, tax tags.....	25.00
Jan.	20	Cochrane Packing Company, tax tags.....	25.00
Jan.	27	Armour & Co., reg. fee.....	25.00
Feb.	1	Armour & Co., tax tags.....	100.00
Feb.	12	Swift & Co., tax tags.....	250.00
Feb.	20	Swift & Co., tax tags.....	125.00
Mar.	3	Cudahy Packing Company, tax tags.....	50.00
Mar.	20	Pulverized Manure Company, tax tags.....	25.00
April	10	Wilson & Co., reg. fee.....	25.00
April	18	Swift & Co., tax tags.....	250.00
June	25	Wilson & Co., tax tags.....	200.00
June	25	Thomas Ruddy Company, tax tags.....	250.00
June	25	Virginia-Carolina Chemical Company, tax tags.....	25.00
June	25	Interstate Fertilizer Company, tax tags.....	300.00
		Total receipts.....	\$8,488.89

DISBURSEMENTS

1918			
July		Central Scientific Company, apparatus.....	\$306.64
July		Building and Repair, repairs.....	1.60
July		Manhattan Gas Company, gas.....	9.12
July		Building and Repair, motor repairs.....	.38
July		L. E. Kott Apparatus Company, rubber stoppers.....	3.27
July		Employees' payroll.....	101.16
Aug.		Building and Repair, chair repairs.....	1.85
Aug.		Denison Manufacturing Company, fertilizer tax tags.....	93.00
Aug.		Building and Repair, pipe repairs.....	4.82
Aug.		Building and Repair, pipe repairs.....	.58
Aug.		Department of Shop Practice, bolts.....	.12
Aug.		Freight.....	2.77
Aug.		Employees' payroll.....	2.75
Sept.		Building and Repair, pipe repairs.....	.46
Sept.		Manhattan Gas Company, gas.....	9.50
Sept.		Grasselli Chemical Company, chemicals.....	74.89
Sept.		Central Mills, corn bran.....	.95
Sept.		Guy Varney loose-leaf notebook.....	2.85
Sept.		Employees' payroll.....	41.05
Oct.		Building and Repair, motor repairs.....	51.15

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Oct.	Electric Heating Apparatus Company, electric muffle repairs.....	\$4.15
Oct.	Employees' payroll	85.08
Oct.	Employees' payroll	212.88
Nov.	Cooperative Book Store, notebooks.....	2.10
Nov.	Central Scientific Company, commutators.....	4.74
Nov.	Central Scientific Company, stopcocks.....	11.20
Nov.	Express	9.45
Nov.	L. E. Knott Apparatus Company, rubber tubing	7.85
Nov.	Employees' payroll	98.23
Dec.	Long Oil Company, gasoline.....	1.40
Dec.	Wareham Telephone Company, phone rent	8.25
Dec.	Employees' payroll	119.17

1919

Jan.	Duckwall Racket Store, screw drivers.....	.60
Jan.	Employees' payroll	94.65
Feb.	Employees' payroll	89.40
Feb.	Officers' payroll	250.00
Mar.	Grasselli Chemical Company, acids.....	41.20
Mar.	Employees' payroll	75.00
Mar.	Department of Shop Practice, speed reducer repairs.....	.65
Mar.	E. H. Sargent & Co., glass tubing.....	8.08
Mar.	Eimer & Amend, glassware.....	4.58
Mar.	Building and Repair, apparatus.....	4.94
Mar.	Manhattan Gas Company, gas.....	20.75
Mar.	Officers' payroll	250.00
Mar.	Employees' payroll	18.23
Apr.	Building and Repair, feed cutter.....	5.66
Apr.	Department of Applied Mechanics, Kansas map.....	.90
Apr.	Building and Repair, electric socket and cluster.....	.90
Apr.	J. H. Day & Co., iron balls for ball mill.....	4.00
Apr.	H. Mueller Manufacturing Company, lead tubing.....	12.30
Apr.	Employees' payroll	75.00
Apr.	Standard Calorimeter Company, sulphur bomb.....	26.37
Apr.	L. T. Anderegg, traveling expense for March.....	71.09
Apr.	C. O. Swanson, traveling expense for March.....	14.80
Apr.	Officers' payroll for March.....	250.00
Apr.	Eimer & Amend, rheostat for type and muffle.....	17.82
Apr.	Department of Shop Practice, reducing pulleys.....	7.61
Apr.	Hull Hardware Company, cord.....	.60
Apr.	Employees' payroll	9.38
May	Building and Repair, repair brushes on centrifuge .....	.96
May	L. R. Eakin, window blinds.....	3.30
May	Ramey Lumber Company, lumber.....	29.49
May	Employees' payroll	150.00
May	Officers' payroll for April.....	250.00
May	Oxygen Gas Company, hydrogen gas.....	2.00
May	Employees' payroll	14.55
June	Employees' payroll	104.86
June	Officers' payroll	250.00
June	Freight	13.46
June	Palace Drug Company, sodium peroxide.....	3.00

Total disbursements	\$3,448.49
Balance on hand June 30, 1919.....	5,040.40
Grand total	\$8,488.89

PART II

THE USE OF COMMERCIAL FERTILIZERS IN KANSAS

L. E. CALL AND R. I. THROCKMORTON

The use of commercial fertilizer has increased rapidly in Kansas during the past five years. The increase in the use of this material has resulted from the fact that farmers in the eastern part of the state who have used fertilizers have met with success and have found that money invested in commercial fertilizer for certain crops was profitably invested. It is reasonable to expect that there will continue to be a gradual increase in the use of commercial fertilizer in those sections

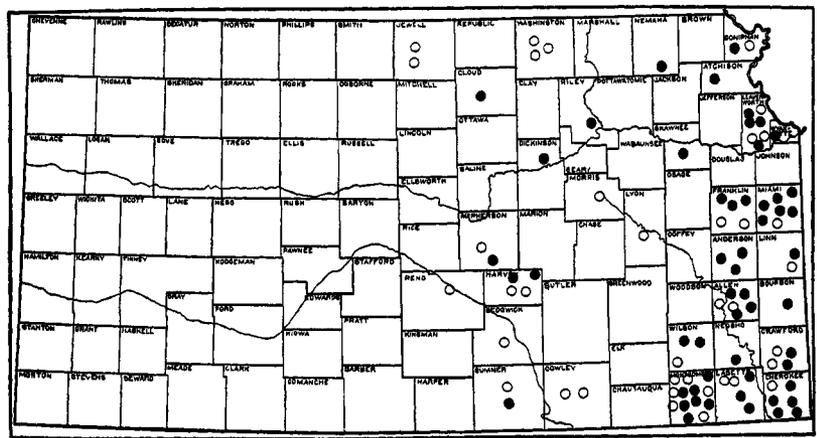


Fig. 2.—Map showing location of cooperative experiments in which commercial fertilizers have been used on wheat. The dots represent experiments in which they were profitable, and the circles experiments in which they were used at a loss

of Kansas where fertilizers give profitable returns. Commercial fertilizers cannot be used profitably in all sections of Kansas at the present time. Climatic conditions in different sections of the state vary so greatly, especially as regards rainfall, that results secured from commercial fertilizers in one section of the state cannot be applied to other sections. In the eastern part of the state where the rainfall is comparatively heavy, plant food has been washed out of the soil to a large extent and it is in this section that commercial fertilizers should

be expected to give profitable returns. Farther west, where the rainfall is lighter and where there has been very little leaching of plant food from the soil, it is not as yet necessary to use commercial fertilizers.

During the past five years the Department of Agronomy of the Kansas Agricultural Experiment Station has conducted in cooperation with farmers a large number of tests with commercial fertilizers on such crops as alfalfa, wheat, oats, and corn. Figure 2 shows the location of these fertilizer tests on wheat and the results. Figure 3 shows a larger area of the state over which at the given places fertilizer has proved profitable on alfalfa. It will be seen from a glance at these maps

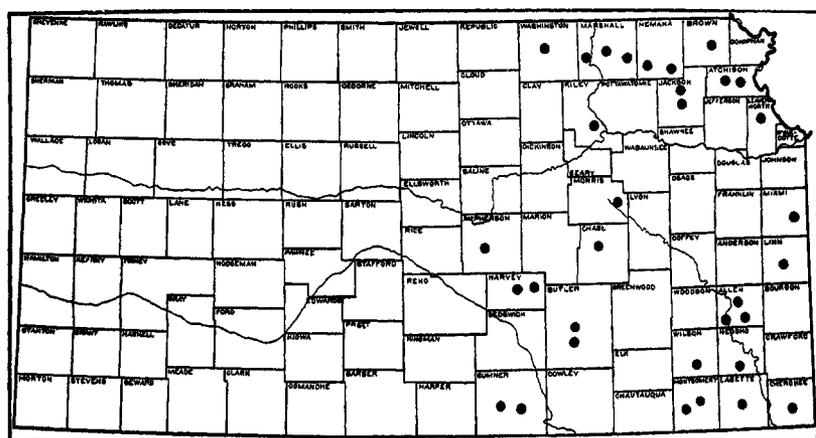


Fig. 3.—Map showing location of cooperative experiments in which commercial fertilizers have been used profitably on alfalfa

that the largest number of tests have been conducted in the three eastern tiers of counties and it is in this section that fertilizers generally have been the most profitable. Farther west in the state commercial fertilizers have been used more commonly on alfalfa and it has been shown as a result of these experiments that commercial fertilizers on alfalfa will pay farther west.

Results of the tests that have been conducted justify recommending the use of commercial fertilizers for wheat on many of the soil types in the eastern one-fifth of Kansas and the use of certain kinds of commercial fertilizers on alfalfa in the eastern two-fifths of the state. It is not possible to use commercial

fertilizers profitably on these crops on all kinds of soil in these sections of Kansas. There is probably no county in Kansas where commercial fertilizers can be used more profitably than in Cherokee County, yet even in this county there are soil types upon which commercial fertilizers have not paid. It is, therefore, necessary for a farmer living in eastern Kansas who contemplates the use of fertilizers either to try the fertilizer on a small area of his land in an experimental way,, or to write to the Agricultural Experiment Station for information as to whether or not commercial fertilizers are likely to prove profitable upon his farm.

FERTILIZERS FOR WHEAT

Commercial fertilizers are used on wheat more commonly in Kansas than on all other crops combined because wheat is grown chiefly as a cash crop and an increase of a few bushels per acre is sufficient to return a profit on the fertilizer. However, the section of the state over which fertilizers may be used profitably on wheat is comparatively small and is limited almost entirely to the eastern three tiers of counties. Even in this area the better limestone, glacial, and bottom land soils will not give a profitable return from the use of fertilizers on this crop. It is on the sandstone, shale, and poorer limestone and glacial soils, that large increases may be expected.

The effect of fertilizers on wheat yields is well shown by Table VI which gives the results of tests conducted in Cherokee County.

TABLE VI.—RESULTS OF FERTILIZER TESTS ON SHALE SOILS IN SOUTHEASTERN KANSAS ¹

TREATMENT	Yield of wheat per acre							Average cost of fertilizer	Value less cost of fertilizer
	1912	1913	1914	1915	1916	Average			
No treatment.....	10 3	5.6	16 3	2 5	6 3	8 2	\$0.00	\$8.20	
Potassium . . .	10 0		15 3	2 1	4 7	(a)8.0	1.00	7.00	
Phosphorus.	22 0	10 3	31 0	16 2	11.7	18.2	3.63	14.57	
Potassium and phosphorus	24 3	11 8	31 0	21.7	12.3	20.2	4.63	15.57	
Potassium, phosphorus, and nitrogen.	16 0	13.6	32 3	23 5	13 0	19 9	5.83	14.07	

(a) Average of four seasons only.

¹ Call, L. E., and Throckmorton, R. I. Soil fertility. Kan. Agr. Expt. Sta. Bul. 220:1-40. Figs. 11. 1918. (Table XII.)

The results secured in this test indicate that phosphorus is the element of plant food that is deficient in this soil. Potassium and nitrogen increased the yield to some extent most seasons, but the increase was only about sufficient to pay for the cost of the fertilizer. When the seedbed for wheat has been well prepared, a fertilizer supplying only phosphorus will be most profitable in the majority of cases. Under such conditions acid phosphate or bone meal may be used to advantage. If the seedbed has been prepared late in the season and the soil is in poor condition, the fertilizer should contain some nitrogen as well as phosphorus. A 2-12-0 combination or bone meal will be most profitable on fields of this nature. There are but few areas in the state where potassium may be used with profit in the production of wheat.

TABLE VII.—RATE OF APPLICATION OF BONE MEAL ON WHEAT IN CHEROKEE COUNTY

Pounds of steamed bone meal per acre	Yield in bushels per acre							Cost of fertilizer: per acre	Value of crop less cost of fertilizer (b)	Increase due to fertilizer
	1914	1915	1916	1917	1918	1919	Av.			
00	15.2	5.4	5.7	15.9	14.9	26.6	18.9		\$27.80	
60	(a)24.6	14.4	8.5	21.0	16.8	25.5	18.4	\$1.12	35.68	\$7.88
90	29.9	15.6	8.9	21.6	19.6	29.6	20.3	1.80	39.80	12.00
120	30.8	16.1	9.3	22.1	20.1	30.3	21.4	2.40	40.40	12.60
150	32.3	15.4	8.9	22.2	21.6	32.1	22.1	3.00	41.20	13.40
180	31.9	17.5	9.5	21.9	19.7	31.5	22.0	3.60	40.40	12.60

(a) Eighty pounds applied in 1914.

(b) Wheat valued at \$2 per bushel; bone meal at \$40 per ton.

AMOUNT OF FERTILIZER TO APPLY ON WHEAT LAND

Results of experiments conducted in Cherokee County (Table VII) indicate that applications of fertilizer on wheat lands should not be extremely heavy. The rates of application varied from 60 to 180 pounds of bone meal per acre. Although the highest average yield and the highest net returns were secured from an application of 150 pounds per acre, the net increase over an application of 90 pounds per acre was not sufficient to justify the heavier application. The profit from the use of 180 pounds of bone meal was the same as from an application of 120 pounds per acre. It is evident from these results that bone meal should be applied at the rate of about 100 pounds per acre under most conditions. Acid phosphate and 2-12-0 fertilizer should be applied at the rate of 125 to 150 pounds per acre.

TABLE VIII.—RESULTS OF FERTILIZER TESTS ON ALFALFA IN ALLEN COUNTY

TREATMENT	Yield in pounds per acre						Increase due to treatment
	1915	1916	1917	1918	1919	Av.	
No treatment	1,233	1,975	4,145	2,399	2,013	2,353	..
Limestone, 2 tons in 1914.	1,805	2,960	4,627	3,160	3,869	3,284	981
Acid phosphate, 250 pounds annually; limestone, 2 tons in 1914.	2,128	2,762	7,401	5,920	7,305	5,303	2,950
Acid phosphate, 250 pounds annually; potassium sulphate, 50 pounds annually; limestone, 2 tons in 1914	2,219	3,880	7,364	6,122	7,294	5,376	3,029

FERTILIZERS FOR ALFALFA

Commercial fertilizers have not been used extensively in Kansas in the production of alfalfa largely because the alfalfa growers of the eastern two-fifths of the state are not familiar with the value of fertilizers on this crop. Experiments have shown that fertilizers may be used profitably in the production of alfalfa on practically all soils of the eastern 46 counties of the state. The results secured from an experiment in Allen County are given in Table VIII. It will be noted that acid phosphate and limestone produced an average increase of 2,019 pounds per acre over the use of limestone alone, and that the addition of potassium sulphate produced an added increase of only 73 pounds per acre. It is evident that phosphorus has a decided influence on the yield of alfalfa and that potassium has practically no effect, at least on this soil. In addition to increasing the yield of alfalfa, phosphorus aids very materially in maintaining a good stand.

For old stands of alfalfa acid phosphate should be used at the rate of about 300 pounds per acre every second year. The application should be made in early spring just before growth begins. In seeding alfalfa it is desirable to use a fertilizer containing some nitrogen, except where the field has had an application of manure on the preceding crop. A good fertilizer to use at seeding time is a 2-12-0 mixture. It should be applied at the rate of 150 pounds per acre either at the time of seeding or just before.

