

LIVESTOCK-FEED BALANCES IN KANSAS
DURING 1966-71

by

613-8302

MICHAEL W. DOXTADER

B.S., Kansas State University, 1971

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE


Agricultural Economics

Department of Economics

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1973

Approved by:



Major Professor

**THIS BOOK
CONTAINS
NUMEROUS PAGES
WITH THE ORIGINAL
PRINTING BEING
SKEWED
DIFFERENTLY FROM
THE TOP OF THE
PAGE TO THE
BOTTOM.**

**THIS IS AS RECEIVED
FROM THE
CUSTOMER.**

LD
2668
T4
1973
D69
C.2
Docu-
ment

ACKNOWLEDGMENTS

I wish to thank Dr. John H. McCoy for his guidance and patience extended to me while putting this thesis together. Many times over, it has been expressed that theory should have practical application. This study is just that.

Also, I wish to thank Dr. Milton Manuel and Dr. Frank Orazem for their critical remarks, as committee members, to make this thesis as perfect and logical as possible.

It is difficult to express the gratitude that is demanded for the unselfish attitude and many lonely nights that my family endured during my program of study. All I can say is thank you.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	ii
LIST OF TABLES	v
LIST OF ILLUSTRATIONS	vii
INTRODUCTION	1

Objectives

Chapter		
I. METHODOLOGY		5
Methodology Used		
Animal Unit--The Concept		
Feed Production		
Feed Consumption		
Feed Balances 1966-71		
Other Possible Approaches		
Original Survey		
Published Secondary Data		
II. 1966-71 LIVESTOCK-FEED BALANCES		17
Feed Grain Balances		
State		
Crop Reporting District		
County		
Harvested Roughage Balances		
State		
Crop Reporting District		
County		
III. POTENTIAL FOR LIVESTOCK EXPANSION BASED ON 1966-71 FEED BALANCES		33
Balance Fed to One Class		
Grain Fed Cattle Expansion		
State		
Crop Reporting District		
County		

Chapter	Page
Hog Expansion State Crop Reporting District County Possible Combinations of Livestock Feeding Wheat	
IV. SUMMARY	56
Limitations Implications	
SELECTED BIBLIOGRAPHY	58
APPENDIXES	
A. Grain-consuming Animal Unit Factors	59
B. Roughage-consuming Animal Unit Factors	62
C. Animal Units for 1967-68 Feeding Year	64
D. Livestock Estimates for Counties	66
E. Grain Fed Cattle Production, as Limited by Harvested Roughages, 1966-71	68

LIST OF TABLES

Table	Page
1. Wheat Fed in the United States, 1960-71	2
2. Major Classes of Livestock and Grain-consuming Animal Unit Factors, Kansas, Based on 1959-60 Feeding Rates . .	8
3. Consumption of Harvested Roughages and Animal Unit Factors, Selected Classes of Livestock, Kansas, 1959-60	9
4. Major Classes of Livestock, Grain-consuming Animal Unit Factors, and Feed Grain Consumption per Animal, Kansas, Feeding Years 1966-71	14
5. Feed Grain Balances by Crop Reporting District and Kansas, 1966-71 and 5 year Average	17
6. Feed Grain Surplus (or deficit) by County, Crop Reporting District, and for Kansas, Feeding Years 1966-71 and 5 year Average	20
7. Harvested Roughage Balances by Crop Reporting District and Kansas, 1966-71 and 5 year Average	27
8. Harvested Roughage Surplus (or deficit) by County, Crop Reporting District, and for Kansas, Feeding Years 1966-71 and 5 year Average	30
9. Potential Additional Grain Fed Cattle Production, Based on Surplus (or deficit) Feed Grain Availability by County, Crop Reporting District, and Kansas, Feeding Years 1966-71 and 5 year Average	35
10. Potential Additional Hog Production, Based on Surplus (or deficit) Feed Grain Availability by County, Crop Reporting District, and Kansas, Feeding Years 1966-71 and 5 year Average	39
11. Additional Grain Fed Cattle that could have been fed from 20 Percent of Wheat Production by County, Crop Reporting District, and Kansas, Feeding Years 1966-70	51

Table**Page**

12. Additional Number of Hogs that could have been fed
from 20 Percent of Wheat Production by County, Crop
Reporting District, and Kansas, Feeding Years 1966-70 . . 53

LIST OF ILLUSTRATIONS

Figure	Page
1. Feed Grain Balance for 1966-67 Feeding Year	22
2. Feed Grain Balance for 1967-68 Feeding Year	23
3. Feed Grain Balance for 1968-69 Feeding Year	24
4. Feed Grain Balance for 1969-70 Feeding Year	25
5. Feed Grain Balance for 1970-71 Feeding Year	26
6. Possible Combinations of Additional Grain Fed Cattle and Hog Production, as Limited by Harvested Roughages, Kansas, Feeding Year 1966-67	43
7. Possible Combinations of Additional Grain Fed Cattle and Hog Production, as Limited by Harvested Roughages, Kansas, Feeding Year 1967-68	45
8. Possible Combinations of Additional Grain Fed Cattle and Hog Production, as Limited by Harvested Roughages, Kansas, Feeding Year 1968-69	46
9. Possible Combinations of Additional Grain Fed Cattle and Hog Production, as Limited by Harvested Roughages, Kansas, Feeding Year 1969-70	47
10. Possible Combinations of Additional Grain Fed Cattle and Hog Production, as Limited by Feed Grains, Kansas, Feeding Year 1970-71	48
11. Possible Combinations of Additional Grain Fed Cattle and Hog Production, as Limited by Harvested Roughages, Kansas, 5 year Average	49

INTRODUCTION

The availability of feed is crucial both to the level and location of livestock production. Feed supplies set an absolute limit to livestock production for the entire livestock industry system under a given state of technology. For any particular locality the constraint may be altered by importation of feeds. Other factors e.g., availability of capital and management resources, weather conditions, transportation costs, local tax structure, community and personal attitudes also affect location of production. This study is not intended to be a complete analysis of all location aspects, but is a study of one important factor (probably the most important) associated with livestock production and potential for further expansion--namely, the current feed availability (surplus or deficit) by area in Kansas. The areas considered were county, crop reporting district, and the entire state. Inter-farm and inter-area feed movements were not considered. Inter-farm movements probably involve only relatively minor quantities which cross area boundaries, and therefore have little effect on area livestock-feed balances. Inter-county, inter-crop reporting district, and inter-state movements undoubtedly are of considerable magnitude, but an analysis of inter-area movements was beyond the scope of this study.

Feed grains were considered to be corn, grain sorghum, barley, and oats. Traditionally, wheat has not been a major source of livestock feed. In recent years, as the relative price of wheat declined,

a decided increase in wheat feeding occurred, Table 1. However, increased export sales in mid-1972 caused wheat prices to rise substantially and, at least temporarily, reduced the importance of wheat as an economic livestock feed grain. It is not certain at this time that wheat can be considered a permanent source of feed. In this study, a separate calculation was made on the potential feed availability if 20 percent of Kansas wheat production were used for feed.

Table 1.--Wheat fed in the United States,
1960-71

Year	Wheat Fed (million bushels)
1960	45.8
1961	54.3
1962	21.4
1963	12.8
1964	68.7
1965	153.8
1966	98.9
1967	57.0
1968	172.0
1969	214.0
1970	206.0
1971 ^a	287.0

Source: U.S. Department of Agriculture,
Wheat Situation, (Washington,
D.C.: U.S. Government Printing
Office, 1962-1972).

^aPreliminary

Quantities of the four feed grains were converted to a common unit--tons, and aggregated. No adjustments were made for variation in feeding value. It is recognized that variations do exist with the greatest differences occurring between oats and barley on one

hand and corn and grain sorghum on the other. However, oats and barley account for only 3-5 percent of Kansas feed grain supplies.

Supplies of harvested roughages were calculated. This included silages, hay, and dry roughage--baled, bundled, stacked, and ensiled. Silages, forages, and hays were considered to have different feeding values due primarily to water content. Two-thirds ton of silage, or one-third ton of forage were considered equal to one ton of hay on a dry hay equivalent basis. No data are available on quantities of feed obtained by grazing stalks, stubble fields, wheat pasture, tame grass pasture, and native grass. However, most livestock programs require some harvested roughages (hay and/or silages) and it is probable that in-so-far as roughages may be a constraint, availability of harvested roughages provides an adequate indication of livestock expansion possibilities.

Consumption by horses, mules, pets, zoo animals, and speciality animals (such as rabbits and fur-bearing animals) were excluded. The consumption of feed grains and roughages by these animals would be relatively small compared to consumption by the livestock and poultry sectors, thus introducing very little bias.

Objectives

The overall objective of this study was the determination of livestock-feed balances in Kansas during 1966-71. Specific objectives were the:

- (1) estimation of feed grain and harvested roughage production
for each area,
- (2) estimation of livestock numbers for each area,

- (3) determination of consumption of feed grains and harvested roughage by area,
- (4) determination of residuals (surplus or deficit) from objectives 1 and 3,
- (5) conversion of surpluses and deficits to potential additional grain fed cattle and hog production for each area.

CHAPTER I

METHODOLOGY

Whatever methodology is used, there would be steps in calculating livestock-feed balances common to all approaches. These would be: (1) determine production of feeds, (2) determine consumption of feeds, and (3) find the difference between 1 and 2.

Methodology Used

Crop and livestock numbers were available from annual series of, "Farm Facts"¹ and Agricultural Statistics."² Consumption of feed grains and harvested roughages were based on methodology used by U.S.D.A. economists.³ Before discussing the method used, it may be helpful to define some of the important terms used throughout this study:

1. Feeding year-- Begins October 1 of one year and ends September 30 of the next year, i.e., the 1966-67 feeding year begins October 1, 1966 and ends September 30, 1967.

¹Kansas State Board of Agriculture, Farm Facts, 1953-1971, (Topeka, Kansas: State Printers Office, 1953-1971). County crop and selected livestock numbers are found in this publication.

²U.S. Department of Agriculture, Agricultural Statistics, 1953-1971, (Washington D.C.: U.S. Government Printing Office, 1953-1971). Annual state livestock numbers were available at state, but not county level.

³Allen, G.C., and M. Devers, National and State Livestock-Feed Relationships, U.S. Department of Agriculture, Statistical Bulletin No. 446 (Washington, D.C.: U.S. Government Printing Office, 1970), p. 88.

2. Animal unit (for feed consumption purposes)-- The average dairy cow in the United States for any given year.
3. Animal unit factor-- The percentage which the average consumption of concentrates or harvested roughages per head per year of a specified class of livestock is of the average consumption of concentrates or harvested roughages by the average dairy cow in the United States, i.e., the average consumption of concentrates by the average dairy cow in Kansas in 1959-60 was 2,364 pounds. The average dairy cow in the United States consumed 2,495 pounds of concentrates for the same period. Thus, the animal unit factor for a Kansas dairy cow is $\frac{2,364}{2,495} = 0.9475$.¹
4. Feeding rate per animal unit-- The average rate of feed grain disappearance per animal unit per year at the national level.²

Animal Unit--The Concept

Grain-consuming and roughage-consuming animal units are similar concepts used in determining an area's feed grain or harvested roughage consumption by livestock. Grain-consuming animal units are used only to arrive at the consumption of feed grains, and roughage-consuming

¹Appendix A and B

²Allen, G.C., and M. Devers, National and State Livestock-Feed Relationships, U.S. Department of Agriculture, Statistical Bulletin No. 446 (Washington D.C.: U.S. Government Printing Office, 1970), p. 88.

animal units only for harvested roughage consumption. Both are based on the amount of concentrates or roughage consumed by the average dairy cow in the United States. The average consumption of concentrates by dairy cows in Kansas was described above. To arrive at grain-consuming animal units for other classes of livestock, the average consumption of concentrates for each class is divided by the average consumption of concentrates for the U.S. dairy cow which is then multiplied by the number of animals in that class for Kansas.¹ Table 2 shows the classes of livestock used and animal unit factors for converting livestock numbers to grain-consuming animal units.

Roughage-consuming animal units were calculated in a manner similar to grain-consuming animal units. Consumption of harvested roughages by the average animal in each class was divided by the average consumption by the U.S. dairy cow to arrive at the roughage-consuming animal unit factor. This factor multiplied by the number of animals in each class gives the number of roughage-consuming animal units. Table 3 indicates the harvested roughages consumed per head per year for selected classes of livestock and animal unit factors.

Feed Production

Production of feed grains (published in bushels) was converted to tons on the basis of official weight per bushel. This permitted aggregation of grain production to a single tonnage figure.

Production of each of the four feed grains was calculated by county by year. County feed grain production is the sum of the four

¹Appendix C

Table 2.--Major classes of livestock and grain-consuming animal unit factors, Kansas, based on 1959-60 feeding rates.^a

Livestock class	Grain-consuming animal unit factors
1. Dairy cows	0.9475
2. Other dairy cattle ^b	0.2204
3. Grain fed cattle ^c	1.9968
4. Other beef cattle ^d	0.0770
5. Hogs fed	0.4168
6. All sheep and lambs ^e	0.0579
7. Hens and pullets	0.0369
8. Chickens raised	0.0088
9. Turkeys raised	0.0365

Source: Allen, G. C., and M. Devers, National and State Livestock-Feed Relationships, U.S. Department of Agriculture, Statistical Bulletin No. 446 (Washington D.C.: U.S. Government Printing Office, 1970), pp. 84 and 88. Animal unit factors, except for grain fed cattle, were taken from this publication.

^aAnimal unit factors are based on feeding rates during 1959-60 feeding year. The time lag between the base period and present feeding rates may have altered the animal unit factors presented in this table. However, there are no estimates of present feeding rates for all classes of livestock considered.

^bReplacement heifers and heifer calves.

^cThis factor was based on 2,500 pounds of concentrates consumed per feeding period. (Preliminary results of project NC-106, Kansas State University, 1972).

^dBeef cows, bulls, beef calves, and dairy calves not kept for replacement.

^eFactors of 0.0585 for stock sheep and 0.0549 for sheep on feed were reported in the source. A combined factor was found by multiplying 0.0585 by 333,000 (state reported number of stock sheep on January 1, 1968) and 0.0549 by 69,000 (state reported number of sheep on feed January 1, 1968), adding the two products, and then dividing by 402,000. This gave a factor of 0.0579, which was used for all five feeding years.

Table 3.--Consumption of harvested roughages and animal unit factors, selected classes of livestock, Kansas, 1959-60.^a

Livestock class	Annual consumption per head			Total	Roughage- consuming animal unit factor
	Hay	Silage ^b	Forage ^b		
		(tons) ^d			
1. Dairy cows ^c	3.50	0.60 ^d		4.10	1.0000
2. Other dairy cattle	1.64	0.67	0.05	2.36	0.5756
3. Grain fed cattle ^e	1.38	0.86	0.01	2.25	0.5488
4. Other beef cattle	0.54	0.09	0.22	0.85	0.2073
5. All sheep and lambs	0.06	0.03	0.02	0.11	0.0268

Source: Allen, G.C., and E.F. Hodges, Feed Consumed by Various Classes of Livestock by States, 1949-50 and 1959-60, With 1964-65 National Estimates and Comparisons, U.S. Department of Agriculture, Statistical Bulletin No. 379 (Washington D.C.: U.S. Government Printing Office, 1966), pp. 16-29. Per head consumption was calculated from this publication.

^aPer head consumption was based on feeding rates during 1959-60. These feeding rates may have changed since that time, but current livestock feeding rates are not available for all classes.

^bDry hay equivalent basis; 2/3 tons of silage or 1/3 tons of forage equals one ton of hay.

^cGeorge Allen and Earl Hodges reported in the source reference, p. 17, over 3 tons of silage fed to the Kansas dairy cow, on a dry hay equivalent basis. U.S. Department of Agriculture, Agricultural Statistics, 1960, p. 378, reported 3.5 tons of all harvested roughage fed to the average dairy cow in Kansas for the winter feeding period. Consequently, 3.5 tons of all harvested roughages for the winter feeding period was used. In 1967-68, the average dairy cow in the U.S. consumed the same amount in the 1959-60 feeding year.

^dU.S. Department of Agriculture, Milk Production, (Washington D.C.: Government Printing Office, 1968), p. 6: this is the sum of silage and forage fed to the average dairy cow in Kansas during the 1967-68 summer feeding period.

^eIncludes enough harvested roughages to compensate for turn-over during the year.

feed grains-- as in equation (1):

$$(1) \quad FGP_{ct} = \sum_{i=1}^4 (P_{ict})(CF_{it})$$

where: FGP_{ct} = production in tons of feed grains in a specified county in a year.

P_{ict} = production in bushels of " i^{th} " feed grain, in county " c ", in year " t ".

CF_{it} = factor for transforming bushels of " i^{th} " feed grain to tons.

i = the four feed grains (1 = corn, 2 = grain sorghum, 3 = oats, 4 = barley).

c = "specified" county.

t = "specified" year (or time period).

County feed production was aggregated by crop reporting district, and by state by summing counties in the respective areas. In general form, the equation for crop reporting district total is:

$$(2) \quad FGP_{dt} = \sum_{i=1}^4 \sum_{c=1_d}^{n_d} FGP_{ict}$$

where: FGP_{dt} = feed grain production for the " d^{th} " district, in year " t ".

c = counties 1, 2, ---, n_d which delineate the " d^{th} " crop reporting district.

1_d --- n_d = specified counties within a given district.

Total state feed grain production may be shown as:

$$(3) \quad FGP_{st} = \sum_{i=1}^4 \sum_{c=1}^{105} FGP_{ict}$$

where: FGP_{st} = total state feed grain production in year "t".

c = 1,2,---,105 (i.e., 105 counties in Kansas).

Harvested roughages were aggregated in tons on a dry hay equivalent basis. To convert to a dry hay equivalent, a factor of two-thirds was used on silages and one-third on dry forages. Dry forages is defined here as dry roughages other than hay. Typically, this is a forage sorghum put up in stacks, bales, or bundles. No conversion was required for hay. Equations are not shown for harvested roughage calculations. They were similar to those above for feed grains.

Feed Consumption

Data on some classes of livestock are not published for Kansas counties. Thus estimates were developed for these counties by prorating the state number of animals to the county level.¹

Consumption of feed grains and harvested roughages was found by multiplying the total grain-consuming and roughage-consuming animal units by the feeding rate per animal unit. Feed grain consumption per animal was calculated as in equation (4) below:

$$(4) \quad FGC_{jt} = (AUF_{jt})(FR_t)$$

where: FGC_{jt} = feed grain consumed per animal of livestock class "j",
in time "t".

¹Appendix D

AUF_{jt} = respective animal unit factor for livestock class "j",
in time "t".

FR_t = feeding rate, i.e., feed grain disappearance per grain-consuming animal unit for feeding year "t".

j = livestock classes (1 = dairy cows, 2 = other dairy cattle, 3 = grain fed cattle, 4 = other beef cattle, 5 = hogs fed, 6 = all sheep and lambs, 7 = hens and pullets, 8 = chickens raised, 9 = turkeys raised).

t = "specified" year (or time period).

County feed grain consumption would then be

$$(5) \quad FGC_{ct} = \sum_{j=1}^9 (A_{cjt})(FGC_{cjt})$$

where: FGC_{ct} = total feed grain consumption in county "c", for year "t".

A_{cjt} = animals in county "c", in livestock class "j", in year "t".

FGC_{cjt} = feed grains consumed per animal in county "c", for livestock class "j", in year "t".

Feed grain consumption by crop reporting district is found by summing county feed grain consumption. In general form, the equation for crop reporting district total is:

$$(6) \quad FGC_{dt} = \sum_{j=1}^9 \sum_{c=1_d}^{n_d} (A_{cjt})(FGC_{cjt})$$

where: FGC_{dt} = feed grain consumption in crop reporting district "d",
in year "t".

$l_d \text{--} n_d$ = specified counties within a given district.

Feed consumption for the entire state is simply the sum of consumption for all nine classes of livestock in the 105 counties:

$$(7) \quad FGC_{st} = \sum_{j=1}^9 \sum_{c=1}^{105} (A_{cjt})(FGC_{cjt})$$

where: FGC_{st} = total feed grain consumption in the entire state during specified year "t".

Consumption of feed grains per grain-consuming animal unit in 1966-67 was 1.130 tons;¹ 1967-68, 1.131 tons; 1968-69, 1.174 tons; 1969-70, 1.202 tons; 1970-71, 1.202 tons;² or an average of 1.1678 tons for the 5 year feeding period.³ Harvested roughage consumption was 4.1 tons per roughage-consuming animal unit and was assumed to remain constant for the 5 year feeding period. Table 4 shows the consumption of feed grains per animal in each class of livestock by feeding year.

Feed Balances 1966-71

The feed balance was determined by subtracting consumption of feed grains and harvested roughages from the production of these inputs

¹Allen, G. C., and M. Devers, National and State Livestock-Feed Relationships, U.S. Department of Agriculture, Statistical Bulletin No. 446 (Washington D.C.: U.S. Government Printing Office, 1970), p. 88.

²Allen, G. C. and E. F. Hodges, National and State Livestock-Feed Relationships, U.S. Department of Agriculture, Supplement to Statistical Bulletin No. 446 (Washington D.C.: U.S. Government Printing Office, 1970), p. 111. Feeding rates were taken from this publication, except for 1970-71, which was assumed to be the same as the 1969-70 feeding year.

³The five year average feeding rate is the simple average of the feeding rates for the individual years.

Table 4.--Major classes of livestock, grain-consuming animal unit factors, and feed grain consumption per animal, Kansas, feeding years 1966-71.^a

Livestock class	Grain- consuming animal unit factor	Consumption of feed grains per animal per year ^b				
		1966-67	1967-68	1968-69	1969-70	1970-71 ^c
		(in pounds)				
1. Dairy cows	0.9475	2141	2143	2225	2278	2278
2. Other dairy cattle	0.2204	498	499	517	530	530
3. Grain fed cattle	1.9968	4513	4517	4688	4800	4800
4. Other beef cattle	0.0770	174	174	181	185	185
5. Hogs fed	0.4168	942	943	979	1002	1002
6. All sheep and lambs	0.0579	131	131	136	139	139
7. Hens and pullets	0.0369	83	83	87	89	89
8. Chickens raised	0.0088	20	20	21	21	21
9. Turkeys raised	0.0365	83	83	86	88	88

^aConsumption of feed grains was converted from tons to pounds for easier reference.

^bConsumption of feed grains per animal per year is determined by multiplying feed grain disappearance per animal unit per year at the national level by the grain-consuming animal unit factor. Grain-consuming animal unit factors are calculated by U.S.D.A.--the latest available being 1959-60. Feed grain disappearance per animal unit per year is calculated annually by U.S.D.A. During the period of this study, feed grain disappearance per animal unit increased, while grain-consuming animal unit factors remained constant (U.S.D.A. did not recalculate these factors during this period), the consumption of feed grain per animal per year showed an increase. This probably overstates consumption of feed grains per animal (and results in an understatement of calculated surplus--deficit feed grain balances, since it may be presumed that some gains in feeding efficiency accrued during this period).

^cFeed grain disappearance for 1970-71 was not available and therefore was assumed to be the same as in the 1969-70 feeding year.

for each county for each year. The residual was expressed as a surplus or deficit. It follows then that the feed grain balance equation would be:

$$(8) \quad \text{Feed Grain Balance} = FGP_t - FGC_t = \sum_{i=1}^4 \sum_{c=1}^{n_a} FGP_{t,c} - \sum_{j=1}^9 \sum_{c=1}^{n_a} FGC_{t,c}$$

where: i = the 4 feed grains.

$1_a \text{---} n_a$ = specified counties (or county) in a specified area.

j = livestock class.

Equations for calculating harvested roughage balances are not shown, since only a slight modification of the equations for feed grain balances would be needed.

Surpluses and deficits of feed grains and harvested roughages were divided by the average consumption of feed grains or harvested roughages per animal in a class of livestock, to estimate expansion potential for that class.

Other Possible Approaches

Alternative approaches, other than what was used, should also be mentioned. Each has advantages and disadvantages.

Original Survey

One possible approach would have been a survey of producers to obtain feeding rates, the number of animals in each class of livestock, feed grains produced for each year and geographic subdivision, and from this deduce the feed balances. This approach would be costly and take

considerable time. It would have to be done annually. Data for past years would be difficult to obtain from producers.

Published Secondary Data

Published information is available on some feeding rates, production of feed grains and roughages, and livestock numbers by county. Estimates of crops and livestock, while subject to some error, are published by the U.S.D.A. In this study, both published and original data were used.

CHAPTER II

1966-71 LIVESTOCK-FEED BALANCES

Feed Grain Balances

Interest centers on the magnitude and trend in surpluses and deficits of feed grains by county, crop reporting district, and the entire state. Table 5 shows surpluses and deficits of feed grains by crop reporting district and the entire state during the period 1966-71 and the 5 year average.

Table 5.--Feed grain balances by crop reporting district and Kansas, 1966-67 abd 5 year average.

Crop reporting district and state	1966-67	1967-68	1968-69	1969-70	1970-71	5 year average
(1,000 tons)						
Northwest	162	129	218	279	332	224
West Central	138	178	236	164	246	192
Southwest	720	795	658	796	922	778
North Central	240	292	309	554	104	300
Central	53	50	25	36	-74	18
South Central	51	8	17	153	18	49
Northeast	752	775	902	870	398	739
East Central	251	340	499	470	-18	308
Southeast	-36	223	173	47	-85	65
State total	<u>2,331</u>	<u>2,792</u>	<u>3,037</u>	<u>3,367</u>	<u>1,845</u>	<u>2,674</u>

^aState total may not sum exactly from district totals due to rounding.

State

Livestock-feed balances increased by over 1 million tons from 1966-67 to 1969-70, i.e., from 2.3 to 3.4 million tons. By any standard, this is a considerable increase. In the 1970-71 feeding year, the balance dropped to 1.8 million tons. This decrease also is of considerable magnitude and points out the vulnerability of crop production to adverse weather and crop disease conditions, which prevailed in certain localities during 1970. Grain sorghum, oats, barley, and corn production dropped from 7.9 million tons in 1969 to 6.7 million tons in 1970. Along with this was an upward surge of grain fed cattle and hog numbers, which also contributed to the drastic fall in feed grain balances.

Crop Reporting District

Most crop reporting districts showed definite upward trends of feed grain balances during 1966-70. A prime example is the North Central district, which increased from 240,000 tons to 554,000 tons, East Central district also increased from 251,000 to 470,000 tons, for the same time period. Southeast, Central, and South Central districts were up and down between 1966-70. Only one district, the Southeast, showed a deficit (1966-67 feeding year) during this time. Three districts (Central, East Central, and Southeast) were deficit areas for the 1970-71 feeding year. Perhaps the most important was the East Central district, which dropped from 470,000 tons to a deficit of 18,000 tons. Of similar magnitude, the North Central district dropped from 870,000 tons to 398,000 tons. But the Southwest district increased from 796,000 to 922,000 tons for the same years. On the average, no district had a deficit balance. The Southwest and Northeast had the largest balances respectively.

County

County feed grain surpluses and deficits are shown in Table 6 and in Figures 1 to 5. Counties consistently having the largest surpluses for the 1966-71 period were Wichita, Grant, Haskell, Morton, Stanton, and Stevens. All are in the Southwest district except Wichita county which is West Central. The largest surplus recorded was 223,335 tons in Stevens county, while Barton county had the largest deficit--102,099 tons for the 1970-71 feeding year. Gove, Clark, Ford, Barton, Ellsworth, Edwards, Pratt, Chase, Cowley, Elk, Greenwood, and Woodson counties had consistent deficits of feed grains during 1966-71.

Cloud, McPherson, Morton, Republic, and Thomas counties had upward trends of feed grain balances during 1966-70. Of particular significance are Osage, Shawnee, and Washington counties, which had sharp upward trends, while Barton county had just the opposite.

Feed balances for many counties fell drastically in 1970-71 from 1969-70. Washington county fell approximately 125.3 thousand tons, followed by Republic, 104.5 thousand; Brown, 95.7 thousand; and Marshall, 94.3 thousand tons. These counties had the largest absolute drops in feed grain balance among the many counties that experienced reductions. However, feed grain balances for Gray county increased by 62.6 thousand tons; Finney, 58.7 thousand; Haskell, 53.6 thousand; and Wichita county with 42.4 thousand tons. All of these counties are in Western Kansas and experienced rapid expansion in irrigation during the period studied. In addition, 10 counties fell from having a surplus in 1969-70 to deficit in 1970-71, but no county went from a deficit to a surplus.

ILLEGIBLE DOCUMENT

**THE FOLLOWING
DOCUMENT(S) IS OF
POOR LEGIBILITY IN
THE ORIGINAL**

**THIS IS THE BEST
COPY AVAILABLE**

Table 6.-- Feed grain surplus (or deficit) by county, crop reporting district, and for Kansas, feeding years 1966-71 and 5-year average.

County, crop reporting district, and state ^a	Feeding Year					5 year average
	1966-67	1967-68	1968-69 (Tons)	1969-70	1970-71 ^b	
Northwest:						
Cheyenne	28,891	19,984	42,811	44,891	49,928	37,301
Decatur	19,937	3,685	7,950	17,534	18,638	13,549
Graham	784	21	4,332	16,730	18,134	8,010
Norton	19,974	8,602	15,456	25,760	22,957	18,550
Rawlins	3,467	-5,003	2,455	1,553	22,213	4,936
Sheridan	369	15,355	13,142	18,993	41,977	17,967
Sherman	67,922	62,125	93,219	96,397	91,885	82,310
Thomas	20,237	24,323	38,421	57,169	65,225	41,369
District Total	162,282	129,087	217,786	279,026	331,777	223,992
West Central:						
Gove	-34,559	-38,009	-22,879	-18,672	-34,000	-29,624
Creeley	4,837	38,475	30,420	25,423	17,260	23,233
Lane	-3,309	5,440	7,053	420	13,044	4,530
Logan	2,472	-2,841	15,898	11,465	15,938	8,586
Jess	-3,771	704	610	8,334	7,791	2,734
Scott	41,646	18,626	50,231	860	24,730	27,219
Trego	2,397	804	10,868	3,418	9,352	5,368
Wallace	28,232	45,987	52,674	49,179	66,775	48,569
Wichita	99,806	108,797	91,116	83,128	125,510	101,671
District Total	137,750	177,984	235,991	163,554	246,432	192,336
Southwest:						
Clark	-8,187	-11,269	-7,612	-10,198	-7,785	-9,010
Finney	56,515	31,618	24,927	22,355	81,660	43,535
Ford	-61,755	-69,141	-92,139	-87,813	-89,558	-80,081
Grant	105,879	132,904	81,785	137,979	118,645	115,438
Gray	42,927	30,939	27,417	32,061	94,696	45,608
Hamilton	27,347	38,659	33,427	41,922	35,835	35,452
Haskell	100,985	121,172	79,630	79,395	132,954	102,827
Hodgeman	4,481	-4,345	4,691	-357	-1,225	495
Kearny	39,581	38,891	36,790	31,336	3,305	29,981
Meade	-4,745	15,114	18,338	39,216	35,599	20,664
Norton	72,547	103,327	107,646	127,734	105,395	103,330
Seward	43,692	52,420	45,472	40,313	36,887	43,777
Stanton	121,588	156,607	141,842	129,319	153,276	149,530
Stevens	178,905	158,562	155,324	211,724	223,335	135,584
District Total	719,761	895,457	647,707	795,655	922,069	773,130
North Central:						
Clay	-3,370	32,835	26,926	39,851	18,970	23,042
Cloud	41,298	49,575	57,733	78,058	57,549	56,843
Jewell	36,143	11,519	25,492	61,711	3,672	27,707
Mitchell	4,220	14,216	10,095	25,155	-10,156	8,706
Osborne	2,556	13,566	1,365	21,180	5,348	8,803
Ottawa	-5,098	-6,392	-313	1,533	463	-1,961
Phillips	26,334	7,782	6,417	25,560	1,970	13,613
Republic	77,355	115,236	135,778	134,587	30,052	98,602
Rooks	-2,393	1,956	1,459	-1,622	-5,958	-1,312
Smith	28,807	16,031	14,984	28,314	-12,135	15,216
Washington	34,339	35,234	28,636	139,333	14,051	50,459
District Total	240,279	292,258	308,573	553,661	193,824	299,717
Central:						
Barton	-11,201	-23,842	-52,132	-92,298	-102,099	-56,296
Dickinson	-12,755	1,088	25,750	19,579	3,634	7,459
Ellis	2,159	2,512	-29,051	-12,679	-23,051	-12,022
Ellsworth	3,822	-836	-3,630	8,169	-955	1,304
Lincoln	-10,749	-9,522	-9,991	-4,251	-9,923	-8,887
McPherson	12,835	13,667	25,941	36,515	17,350	21,262
Marion	21,027	33,770	39,599	15,326	9,757	23,882
Rice	39,349	21,643	9,173	30,996	15,739	23,390
Rush	8,836	8,618	9,095	23,239	11,345	12,235
Russell	1,403	3,567	-2,341	7,125	2,959	2,543
Saline	-1,686	-494	12,870	3,720	1,652	1,226
District Total	53,091	50,051	25,283	35,591	-73,542	18,095

Table 6.--Continued

South Central:						
Barber	-2,807	-7,748	-6,256	8,942	4,175	-739
Comanche	-1,671	550	-3,638	-5,363	-5,827	-3,190
Edwards	9,281	13,734	4,384	4,011	1,446	6,571
Harper	-6,770	-15,329	-11,642	-6,412	-4,295	-8,893
Harvey	12,702	18,353	29,943	25,096	-9,435	15,422
Kinsman	-8,174	-13,152	-6,334	5,374	-14,818	-7,421
Kiowa	-8,340	-1,784	-2,627	2,263	3,018	-1,494
Pawnee	1,196	19,611	-3,456	15,332	7,767	6,800
Pratt	-23,836	-28,526	-43,751	-51,403	-55,644	-40,646
Reno	37,810	19,249	16,115	47,723	27,656	27,911
Sedgwick	12,550	6,010	28,604	31,210	2,914	16,270
Stafford	21,887	20,241	18,936	52,430	36,478	29,994
Sumner	6,768	-14,206	3,097	23,143	24,863	8,733
District total	50,595	8,031	17,428	153,086	18,299	49,482
Northeast:						
Atchison	71,339	46,705	91,487	75,516	32,591	63,528
Brown	152,052	175,371	165,607	178,604	82,890	150,905
Doniphan	120,416	125,050	121,631	124,442	104,334	119,175
Jackson	54,420	53,173	86,138	63,505	18,616	55,170
Jefferson	72,654	58,953	100,335	69,683	35,593	67,438
Leavenworth	29,708	21,750	35,761	29,659	25,126	23,401
Marshall	130,291	125,547	144,033	155,383	61,565	123,464
Nemaha	87,307	87,974	106,690	77,422	29,083	77,635
Pottawatomie	26,821	46,934	22,066	38,639	4,855	27,863
Riley	3,392	25,879	23,712	49,054	2,053	20,916
Wyandotte	3,123	8,145	4,740	7,116	1,383	4,931
District total	752,022	775,472	902,170	869,523	398,089	739,455
East Central:						
Anderson	28,525	24,550	35,210	52,146	5,840	29,254
Chase	-88,832	-87,394	-86,498	-89,173	-96,632	-89,716
Coffey	10,392	22,277	44,169	27,201	-12,943	18,219
Douglas	45,400	40,503	59,692	37,335	2,194	36,905
Franklin	28,379	15,625	20,885	37,765	3,622	21,195
Geary	3,213	9,282	29,321	16,189	536	11,734
Johnson	42,600	50,062	63,839	49,884	23,947	40,066
Linn	22,422	26,033	45,005	34,596	8,998	27,461
Lyon	-14,496	16,768	25,231	15,512	-27,831	3,037
Miami	54,965	50,344	73,057	69,761	7,793	51,184
Norris	-9,311	25,217	18,873	3,900	-10,986	5,540
Osage	58,198	66,681	72,152	104,449	41,144	68,525
Shawnee	65,597	78,947	92,459	101,225	57,065	79,059
Wabaunsee	3,904	1,381	6,188	8,731	-20,225	-4
District total	250,656	340,326	498,987	469,801	-17,528	308,448
Southeast:						
Allen	23,122	46,896	30,593	30,877	18,083	29,896
Bourbon	-4,036	31,062	20,052	19,296	3,836	14,052
Butler	-29,687	-19,534	15,891	-27,730	-78,585	-27,923
Chautauqua	-4,266	-3,057	-1,324	1,297	-4,810	-2,432
Cherokee	7,356	37,935	26,495	13,194	19,587	20,913
Cowley	-841	-14,328	-29,979	-35,051	-38,721	-23,784
Crawford	10,551	45,209	41,140	39,922	29,807	33,340
Elk	-13,394	-10,914	-11,525	-9,441	-9,877	-11,030
Greenwood	-14,307	-3,013	-4,136	-14,489	-11,036	-9,416
Labette	-6,359	21,887	-6,553	-16,933	-25,369	-6,475
Montgomery	3,273	23,948	34,464	8,619	9,457	15,952
Neosho	128	31,155	23,945	22,093	10,173	17,499
Wilson	4,181	42,568	44,096	18,401	17,619	25,373
Woodson	-11,394	-6,454	-10,023	-3,693	-24,918	-11,296
District total	-35,671	223,270	173,036	47,202	-84,753	64,643
State total	2,330,752	2,791,905	3,037,010	3,307,173	1,844,635	2,074,290

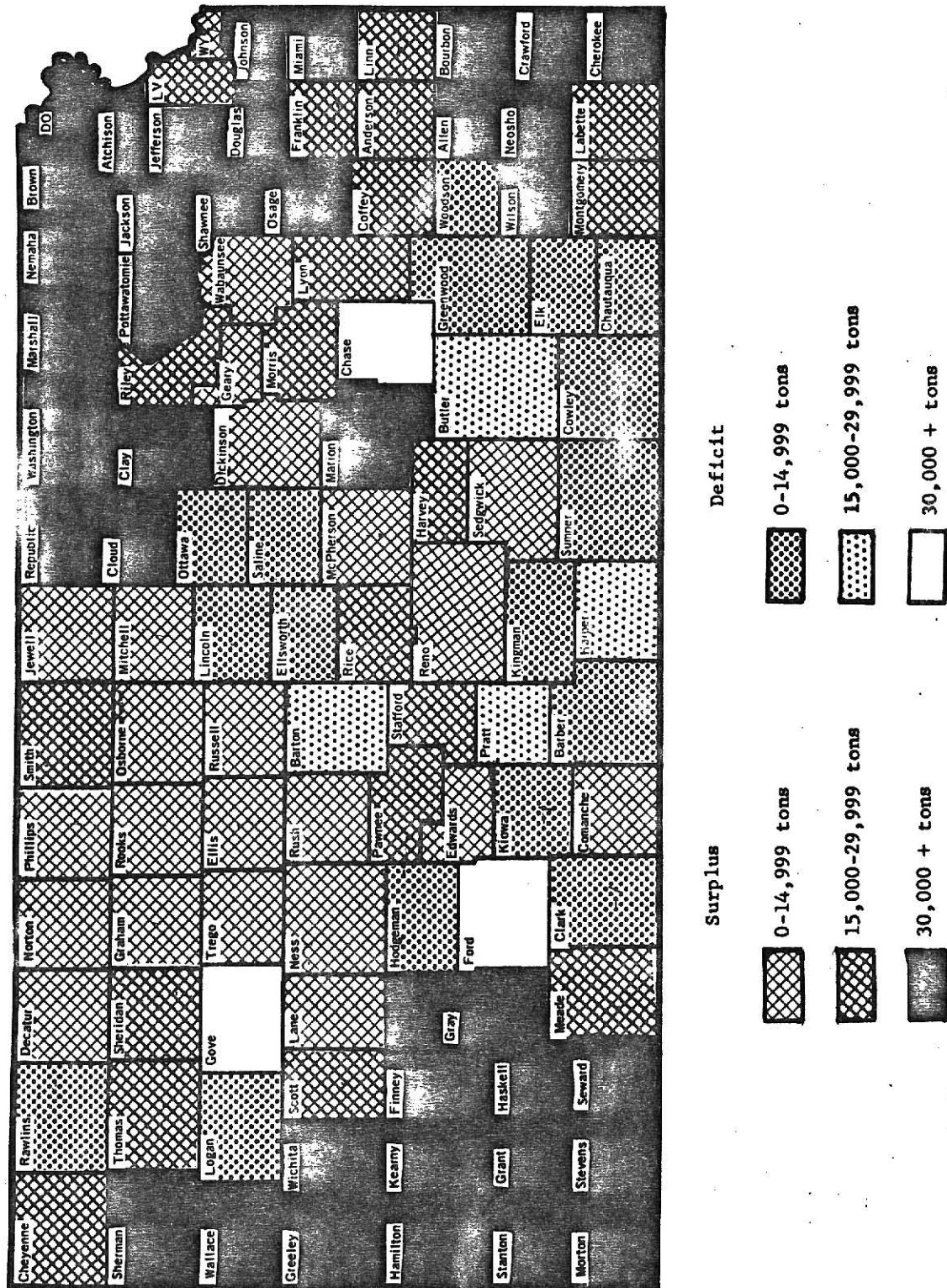
^aDistrict totals may not sum exactly from county figures due to rounding.

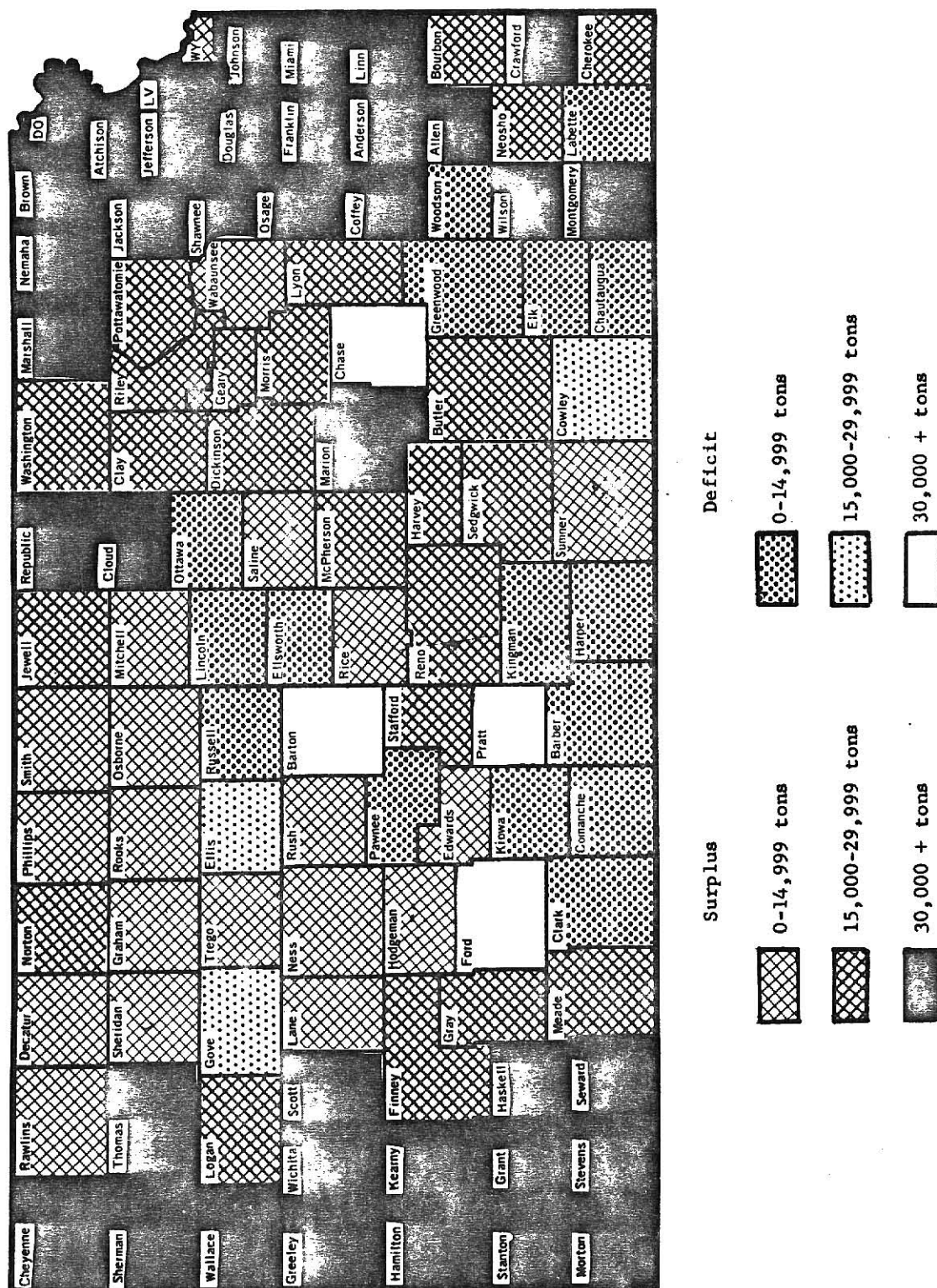
^bPreliminary. Cattle on feed were estimated from 1970 grain fed cattle marketed and feeding rates were the same as in 1969.

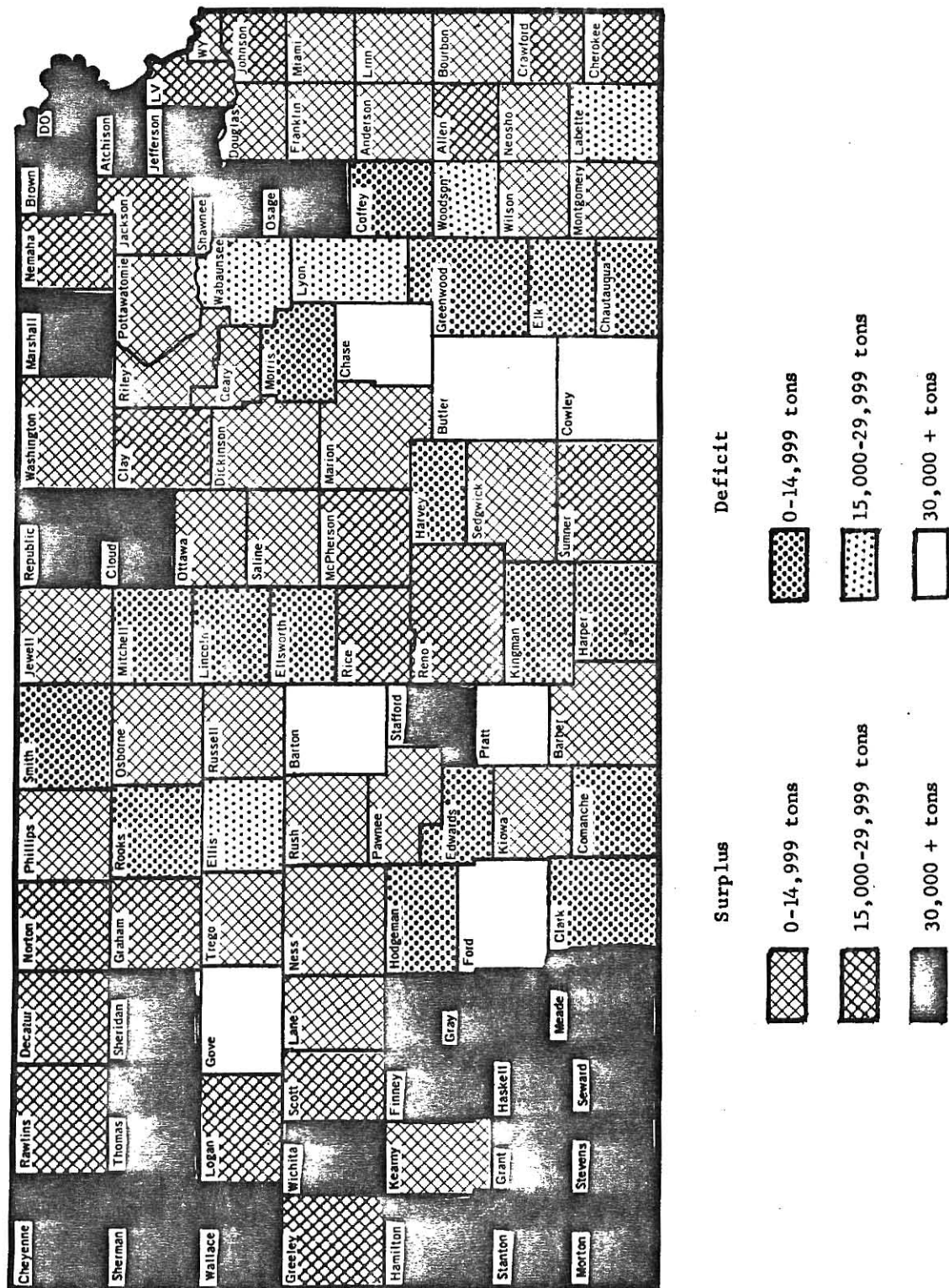
**THIS BOOK
CONTAINS
NUMEROUS PAGES
WITH DIAGRAMS
THAT ARE CROOKED
COMPARED TO THE
REST OF THE
INFORMATION ON
THE PAGE.**

**THIS IS AS
RECEIVED FROM
CUSTOMER.**

Fig. 2.--- Feed grain balance for 1967-68 feeding year.







Harvested Roughage Balances

Of equal importance are harvested roughage balances. The magnitude and direction of trends for each county, crop reporting district, and for the entire state require the same attention as those for feed grains. Table 7 shows surpluses and deficits of harvested roughages by crop reporting district and the entire state during the 1966-71 period and the 5 year average.

Table 7.--Harvested roughage balances by crop reporting district and Kansas, 1966-71 and 5 year average.

Crop reporting district and state	1966-67	1967-68	1968-69	1969-70	1970-71	5 year average
(1,000 tons)						
Northwest	112	120	97	63	5	79
West Central	-53	-69	-73	-47	-190	-86
Southwest	-162	-88	-140	-253	-413	-211
North Central	155	358	215	314	-18	205
Central	172	360	88	216	-80	151
South Central	121	234	63	177	-78	103
Northeast	142	218	251	224	0	167
East Central	132	393	269	256	-60	198
Southeast	-5	247	92	-28	-297	2
State total ^a	614	1,774	863	922	-1,130	608

^aState total may not sum exactly from district totals due to rounding.

State

Harvested roughage balances increased by 308,000 tons from 1966 to 1970, i.e., from 614 thousand tons to 922 thousand tons. In the 1967-68 feeding year, the surplus jumped to the highest level--1,774,000 tons. This was considerably above all other feeding years and above the

5 year average. The largest single reason for the jump was hay production, which increased by 36 percent over the 1966 level. Just the opposite was the case in 1970-71, where the harvested roughage balance dropped to a deficit of 1,130,000 tons. Production of corn silage was up, but forage and hay production were down sharply from the 1969-70 feeding year. It is clear that roughage surpluses occur most frequently in the Central and Eastern districts of Kansas.

Crop Reporting District

Trends of harvested roughage balances were mixed for the nine districts during 1966-71. West Central and Southwest Kansas have had consistent deficits. This is due primarily to hay production, which is typically far less than the Central or Eastern sections of Kansas. Southeast Kansas had small deficits for 2 feeding years, but also had a small and a large surplus during 1966-70. The Northwest district went from a declining trend to a slightly rising trend and then fell sharply. A large increase, then a sharp decrease followed by a large increase were characteristic of the Central and South Central district trends. Southwest district had the largest deficit--253,000 tons, while the East Central district had the largest surplus--393,000 tons.

As stated before, harvested roughage balances dropped drastically for the 1970-71 feeding year. The Northwest district was the only district to have a surplus of harvested roughages in the 1970-71 feeding year and that was only 5,000 tons. North Central, Central, South Central, and East Central district fell from surplus to deficit areas from 1969-70 to 1970-71. Districts that had deficits in the 1969-70 feeding year had larger deficits in the 1970-71 feeding year.

County

County harvested roughage balances are presented in Table 8. Ford, Chase, Seward, Pratt, Gove, Labette, and Scott counties all had deficits of over 50,000 tons for some feeding year during 1966-70. By a large margin, Ford county had the largest deficit and the largest consistent deficit for the first four feeding years. Chase, Pratt, and Gove counties were consistent areas of large deficit balances.

Dickinson, Jewell, Pottawatomie, Reno, Ottawa, Osage, Sumner, Sedgwick, Marshall, and Lincoln counties had surpluses of over 50,000 tons for some feeding year during 1966-70. Dickinson county, with 85,592 tons, had the largest surplus for any feeding year.

Counties having upward or downward trends are of particular importance. Gray and Atchison counties had upward trends of surpluses during 1966-70, but Brown county, with deficits, moved upward toward equilibrium. Ford, Grant, Labette, and Pratt counties, all deficit areas, experienced downward trends with larger deficits. Jackson and Norton counties remained approximately at constant levels of surplus during 1966-70. However, Clark county remained at about the same amount of deficit for each feeding year during the same time period.

Most counties had decreases in harvested roughage balances in the 1970-71 feeding year as compared with 1969-70. However, Clay, Clark, Graham, Greeley, Kearny, and Stevens counties had increases. Only Kearny and Stevens counties went from a deficit in 1969-70 to a surplus in 1970-71. This undoubtedly was attributable to irrigation.

Table 8.--Harvested roughage surplus (or deficit) by county, crop reporting district, and for Kansas, feeding years 1966-71 and 5 year average.^a

County, crop reporting district, and state ^b	Feeding year					5 year average
	1966-67	1967-68	1968-69 (tons)	1969-70	1970-71	
Northwest:						
Cheyenne	-687	47,671	-1,878	10,844	-7,323	9,725
Decatur	11,513	11,178	4,800	9,997	-4,709	6,556
Graham	21,038	18,743	22,935	14,360	16,662	18,748
Norton	24,986	20,453	17,196	20,553	7,075	18,113
Rawlins	28,025	2,877	-3,719	6,970	5	6,832
Sheridan	-6,592	2,933	11,054	-13,635	-1,907	-1,639
Sherman	23,397	23,450	32,405	20,727	2,656	20,527
Thomas	10,519	-7,537	14,188	-6,791	-7,904	495
District total	112,199	119,763	96,980	63,277	4,554	79,356
West Central:						
Cove	-48,400	-55,187	-16,709	-20,614	-61,113	-40,405
Greeley	-7,493	-1,565	-5,429	9,096	12,152	1,330
Lane	-17,849	-11,114	-18,856	-14,141	-32,223	-18,837
Logan	-3,825	6,119	2,287	8,611	-6,139	1,411
Ness	-3,831	-7,101	6,030	13,722	-15,559	-1,346
Scott	-9,520	-6,581	-19,334	-50,329	-39,225	-25,006
Trego	8,690	1,927	2,873	8,093	-6,562	3,095
Wallace	14,079	8,948	7,546	18,038	13,093	12,342
Wichita	15,563	-4,293	-31,556	-19,448	-53,949	-18,719
District total	-52,588	-68,779	-73,198	-47,947	-189,510	-86,224
Southwest:						
Clark	-28,640	-31,743	-33,688	-31,664	-30,787	-31,334
Finney	-11,795	-23,164	45,533	38,131	-2,635	9,214
Ford	-73,526	-72,442	-100,815	-103,783	-119,132	-93,941
Grant	-396	-5,154	-10,061	-39,706	-46,841	-20,432
Gray	-22,782	-16,626	9,080	10,909	-67,234	-17,331
Hamilton	17,042	49,017	19,569	32,349	12,459	26,085
Haskell	-21,755	-472	-40,449	-17,430	-33,068	-22,635
Hodgeman	-18,474	-8,116	-22,484	-4,080	-16,152	-13,861
Kearny	12,648	16,039	16,161	-27,746	5,888	4,598
Meade	-14,987	-10,823	-31,361	-14,918	-14,943	-17,497
Morton	7,200	637	10,704	4,685	-1,568	4,332
Seward	3,538	14,713	-2,485	-61,066	-61,911	-21,442
Stanton	-9,139	-10,513	94	-37,297	-37,575	-18,886
Stevens	-1,339	11,033	566	-1,221	96	1,827
District total	-162,405	-87,620	-139,636	-252,550	-413,403	-211,183
North Central:						
Clay	10,323	38,449	12,052	8,138	14,036	16,600
Cloud	26,392	43,304	37,536	37,341	19,004	32,715
Jewell	23,585	72,761	43,673	49,980	-1,902	37,619
Mitchell	17,119	24,154	-8,364	21,241	-11,542	8,522
Osborne	8,730	25,395	19,226	43,300	-7,461	17,838
Ottawa	31,582	59,253	29,965	41,127	10,052	34,396
Phillips	15,766	17,766	36,093	34,075	10,471	22,834
Republic	15,138	5,296	3,413	7,012	-9,238	4,324
Rooks	6,275	11,873	27,970	25,043	1,230	14,478
Smith	1,491	10,788	2,533	37,777	185	10,555
Washington	-1,105	46,830	10,879	8,369	-42,526	4,993
District total	153,297	357,869	214,976	313,922	-17,693	204,374
Central:						
Barton	34,235	-6,463	-22,527	-39,968	-85,379	-23,840
Dickinson	14,954	85,592	43,808	40,259	13,971	39,717
Ellis	10,901	11,478	-28,468	10,886	-24,484	-4,117
Ellsworth	23,261	13,696	3,758	33,477	4,385	15,723
Lincoln	14,754	51,261	19,456	33,680	4,065	24,607
McPherson	8,029	48,018	18,270	23,874	-6,477	18,343
Marion	17,012	49,879	49,560	22,287	14,181	30,584
Rice	12,033	21,630	-8,608	24,611	1,209	10,185
Rush	2,724	12,099	-1,071	3,145	-7,644	28,710
Russell	13,183	27,713	6,686	27,281	-5,478	13,877
Saline	22,198	44,331	8,070	29,433	11,681	23,293
District total	172,273	359,783	88,035	215,885	-79,770	151,241

Table 8.-- Continued

South Central:						
Barber	-8,667	-10,117	-13,678	10,933	-39,112	-12,128
Comanche	-15,551	-6,501	-10,756	-3,300	-18,098	-10,841
Edwards	19,895	22,627	19,162	5,704	-601	13,357
Harper	-8,952	4,954	-9,121	16,207	-15,469	-2,476
Harvey	-1,869	30,422	-3,459	10,193	9,372	8,932
Kingman	24,718	9,529	14,202	12,459	7,069	13,595
Kiowa	-43	1,581	-8,791	-3,303	-8,767	-3,865
Pawnee	4,979	12,914	17,750	11,399	9,848	11,378
Pratt	-19,752	-25,361	-45,873	-55,942	-80,867	-45,559
Reno	54,070	57,854	26,411	62,066	26,422	45,365
Sedgwick	24,032	53,738	33,046	35,092	16,746	32,531
Stafford	33,301	28,209	12,962	36,246	20,046	26,153
Sumner	14,366	54,199	31,541	38,812	-4,413	26,901
District total	120,527	234,048	63,395	176,566	-77,824	103,342
Northeast:						
Atchison	5,171	8,546	18,548	21,294	4,454	11,603
Brown	-30,140	-25,451	-16,868	-12,544	-23,203	-21,641
Doniphan	-13,480	2,937	-4,991	7,073	-5,680	-2,828
Jackson	41,712	49,863	44,484	41,863	14,822	38,549
Jefferson	33,714	20,842	43,744	14,130	6,177	23,721
Leavenworth	23,364	22,430	43,580	35,544	15,986	28,181
Marshall	22,530	52,122	46,361	42,353	3,789	33,431
Nemaha	2,049	-12,162	-22,078	-3,743	-49,102	-17,007
Pottawatomie	21,457	50,045	66,581	60,231	26,938	45,050
Riley	27,496	31,420	26,540	16,669	7,631	21,951
Wyandotte	7,996	17,847	5,343	878	-1,604	6,092
District total	141,870	218,439	251,244	223,747	207	167,101
East Central						
Anderson	1,881	28,091	16,608	35,149	25,867	21,519
Chase	-63,834	-39,029	-70,730	-58,791	-71,620	-60,801
Coffey	20,542	30,222	29,977	45,188	-498	25,086
Douglas	31,001	37,949	31,701	25,232	11,743	27,525
Franklin	7,902	12,626	46,854	7,978	-10,695	12,933
Geary	5,248	29,503	12,430	11,072	1,575	11,967
Johnson	24,253	22,328	36,481	32,299	4,548	21,782
Linn	9,679	34,862	17,163	32,522	-1,885	18,468
Lyon	-26,209	7,459	-25,150	-14,097	-34,477	-18,495
Miami	32,864	40,284	29,537	46,146	-11,538	27,459
Morris	450	46,039	23,528	25,720	11,652	21,478
Osage	29,839	55,274	53,271	29,290	3,951	34,325
Shawnee	35,273	40,715	28,835	24,050	3,845	26,544
Wabash	23,069	46,934	38,943	25,136	7,838	28,385
District Total	131,960	303,269	269,448	255,894	-59,692	198,176
Southeast:						
Allen	7,051	38,219	19,176	33,153	12,332	21,986
Bourbon	42,172	37,804	28,397	29,925	6,263	28,912
Butler	-35,843	19,698	3,997	-7,441	-76,153	-19,148
Chautauqua	-18,080	-6,043	-4,331	-8,821	-18,810	-11,217
Cherokee	7,062	5,753	1,789	4,231	-9,387	1,890
Cowley	-15,637	14,125	-6,780	-39,747	-61,436	-21,895
Crawford	6,666	10,280	821	7,843	-2,749	4,572
Elk	-16,436	14,744	3,268	-3,191	-16,887	-3,700
Greenwood	-3,370	21,660	16,382	-12,733	-31,274	-1,867
Labette	-22,458	-22,189	-37,222	-51,415	-46,943	-36,045
Montgomery	15,970	22,501	7,717	3,764	-5,657	8,859
Neosho	3,856	9,721	10,053	929	-8,468	3,218
Wilson	8,973	49,456	24,440	12,456	3,761	19,817
Woodson	15,097	31,153	24,114	3,248	-41,772	6,368
District Total	-4,977	246,881	91,821	-27,797	-297,180	1,750
State total	614,156	1,773,658	863,065	921,597	-1,130,311	608,433

^a In terms of dry hay equivalents, three tons of silage or two tons of forage equals one ton of dry hay.

^b District totals may not sum exactly from county figures due to rounding.

The aggregation of harvested roughages covered up the fact that all area deficits were in hay--not in silage or the so-called dry roughage feed crops (i.e., sudan, sorghum, etc.). Deficits in hay are rather easily met by transporting hay from areas of surplus.

CHAPTER III

POTENTIAL FOR LIVESTOCK EXPANSION-- BASED ON 1966-71 FEED BALANCES

Potential for further expansion of the livestock industry is a matter of substantial interest. Cash receipts from hog marketings rank second, grain fed cattle marketings is first, in the livestock sector of Kansas. Livestock production and associated meat packing activities are among the highest in income multiplier effect of all economic sectors in the state of Kansas.¹ The 1971 decision of Oscar Mayer, Inc. to build a new pork packing plant in Pottawatomie County, Kansas was based in part on the availability of feed for further hog production.

Feed balances (i.e., surplus or deficit position) as determined in the previous chapter were the bases for estimating potential livestock expansion. Livestock expansion is positive when an area has a surplus of feed grains or harvested roughages and is negative when an area has a deficit of feed grains or harvested roughages. When a county has a deficit balance of feed, livestock expansion potential will be termed no expansion potential. Although realistically

¹Emerson, M. J., et al, "The Interindustry Structure of the Kansas Economy," Kansas Department of Economic Development Planning Division, State of Kansas, Report No. 21, Manhattan, Kansas, January 1969. Table 10-3, p. 153.

an area with a deficit balance imports feed from areas of surplus, it was necessary to determine how many cattle and hogs were produced in that area from importation of feeds.

Balance Fed to One Class

The first approach used in estimating potential livestock expansion assumed the entire net surplus was fed to only one class of livestock at a time. This gives the maximum additional number of animals that could have been fed from these surpluses of feed grains and harvested roughages.¹ Tables 9 and 10 indicate the maximum additional number of grain fed cattle or hogs, respectively, that could have been fed in each county over and above current livestock numbers.

GRAIN FED CATTLE EXPANSION

State

Kansas could have fed an additional 2.1 million head of cattle per year on the average during the 1966-71 period (Table 9). From 1966-70, the trend in potential grain fed cattle expansion increased from 1.9 million in 1966-67 to 2.7 million head in 1969-70. As mentioned before, the 1970-71 feeding year was one of adverse weather and crop disease conditions, which resulted in a drastic drop in expansion potential. Kansas could have fed another 2.7 million head in 1969-70, but only 1.5 million more in 1970-71.

Crop Reporting District

By far, the Southwest and Northeast crop reporting districts had the greatest expansion potential for grain fed cattle. Central, South

¹Grain fed cattle expansion potential, as limited by harvested roughages, is in Table E-1, Appendix E.

Table 9.--Potential additional grain fed cattle production, based on surplus (or deficit) feed grain availability by county, crop reporting district, and Kansas, feeding years 1966-1971 and 5 year average.^a

County, crop reporting district, and state	Feeding Year ^b					5 year average
	1966-67	1967-68	1968-69	1969-70	1970-71	
	(number of head)					
Northwest:						
Cheyenne	23,113	15,987	34,249	35,913	39,942	29,841
Decatur	15,950	2,948	6,360	14,027	14,910	10,839
Graham	627	17	3,466	13,384	14,547	6,408
Norton	15,979	6,882	12,365	20,608	18,366	14,840
Rawlins	2,744	-4,006	1,964	1,242	17,770	3,949
Sheridan	295	12,284	10,514	15,194	33,582	14,374
Sherman	54,338	49,700	74,575	77,118	73,508	65,848
Thomas	16,750	19,458	30,737	45,735	52,796	33,095
District Total	129,826	103,270	174,229	223,221	265,422	179,193
West Central:						
Gove	-27,647	-30,407	-18,303	-14,938	-27,200	-23,699
Greeley	3,870	30,780	24,336	20,338	13,808	18,626
Lane	-2,647	4,352	5,642	336	10,435	3,624
Logan	1,978	-2,273	12,718	9,172	12,750	6,869
Ness	-3,017	563	488	6,667	6,233	2,187
Scott	33,317	14,901	40,185	688	19,784	21,775
Trego	1,918	643	8,694	2,734	7,482	4,294
Wallace	22,586	36,790	42,139	39,343	53,420	38,856
Wichita	79,845	87,038	72,892	66,502	100,408	81,337
District Total	110,200	142,387	188,793	130,843	197,122	153,869
Southwest:						
Clark	-6,550	-9,015	-6,090	-8,158	-6,228	-7,208
Finney	45,212	25,294	19,942	18,364	65,328	34,828
Ford	-49,404	-55,313	-73,711	-70,250	-71,646	-64,065
Grant	84,703	106,323	65,428	110,383	94,916	92,351
Gray	34,342	24,751	21,934	25,649	75,757	36,486
Hamilton	21,878	30,927	26,742	33,594	28,668	28,362
Haskell	80,788	96,938	63,704	63,516	106,363	82,262
Hodgeman	3,585	-3,476	3,753	-286	-1,596	396
Kearny	31,665	31,113	29,432	25,069	2,644	23,984
Meade	-3,796	12,091	14,670	31,373	28,319	16,532
Morton	58,038	82,662	86,117	102,187	84,316	82,664
Seward	34,954	41,936	36,458	32,250	29,510	35,021
Stanton	97,270	125,286	113,474	103,455	122,637	112,424
Stevens	143,124	126,850	124,315	169,379	178,668	148,467
District Total	575,809	636,366	526,166	636,524	737,655	622,504
North Central:						
Clay	-2,696	26,268	21,541	31,881	15,176	18,434
Cloud	33,038	39,660	46,186	62,446	46,039	45,474
Jewell	28,914	9,215	20,394	49,369	2,938	22,166
Mitchell	3,376	11,373	8,076	20,124	-8,125	6,965
Osborne	2,045	10,853	1,092	16,944	4,278	7,042
Ottawa	-4,078	-5,114	-250	1,226	370	-1,569
Phillips	21,067	6,226	5,134	20,448	1,576	10,890
Republic	61,884	92,189	108,622	107,670	24,042	78,881
Rooks	-1,914	1,565	1,167	-1,298	-4,766	-1,049
Smith	23,110	12,825	11,987	22,651	-9,708	12,173
Washington	27,471	28,747	22,909	111,466	11,241	40,367
District Total	192,216	233,806	246,858	442,929	83,059	239,774
Central:						
Barton	-8,961	-19,074	-41,706	-73,766	-81,679	-45,037
Dickinson	-10,204	870	20,600	15,663	2,907	5,967
Ellis	1,727	2,010	-23,241	-10,143	-18,441	-9,618
Ellsworth	3,059	-709	-2,904	6,535	-764	1,043
Lincoln	-8,599	-7,618	-7,993	-3,401	-7,938	-7,110
McPherson	10,268	10,934	20,753	29,212	13,880	17,009
Marion	16,822	26,960	31,679	12,261	7,806	19,105
Rice	31,479	17,314	7,338	24,797	12,631	18,712
Rush	7,109	6,894	7,276	18,584	9,076	9,788
Russell	1,122	2,854	-1,873	5,700	2,367	2,034
Saline	-1,349	-395	10,296	3,032	1,322	2,581
District Total	42,473	40,041	20,226	28,473	-58,834	14,476

Table 9.-- Continued

South Central:						
Barber	-2,246	-6,198	-5,005	7,154	3,340	-591
Comanche	-1,337	440	-2,910	-4,290	-4,662	-2,552
Edwards	7,425	10,987	3,507	3,209	1,157	5,257
Harner	-5,416	-12,463	-9,314	-5,130	-3,436	-7,112
Harvey	10,162	14,682	23,954	20,717	-7,548	12,393
Kingman	-6,539	-10,522	-5,067	4,299	-11,854	-5,937
Kiowa	-6,672	-1,427	-2,102	1,810	2,414	-1,195
Pawnee	957	15,689	-7,565	12,266	6,214	5,512
Pratt	-19,069	-22,821	-35,007	-41,170	-44,515	-32,516
Reno	30,248	8,199	12,892	38,178	22,125	22,328
Sedewick	10,040	4,808	22,931	24,968	2,331	13,016
Stafford	17,510	16,193	15,149	41,944	29,182	23,996
Sumner	5,414	-11,365	2,478	18,514	19,890	6,986
District Total	40,476	6,401	13,942	122,469	14,639	39,585
Northeast:						
Atchison	57,071	37,364	73,190	60,413	26,073	50,822
Brown	121,642	140,297	132,486	142,883	66,312	120,724
Doniphan	96,333	100,040	97,305	99,554	83,467	95,340
Jackson	43,536	42,538	68,910	50,304	14,893	44,136
Jefferson	58,123	47,162	60,244	55,746	28,474	53,950
Leavenworth	23,766	17,400	28,609	23,727	20,101	22,721
Marshall	104,233	100,438	115,226	124,706	49,252	98,771
Memah	69,846	70,379	85,352	61,938	23,266	62,156
Pottawatomie	21,457	37,547	17,653	30,911	3,884	22,290
Riley	3,114	29,696	18,979	39,243	1,642	16,733
Wandotte	2,498	6,516	3,732	5,693	1,106	3,221
District Total	601,618	620,378	721,736	695,618	318,471	591,564
East Central:						
Anderson	22,820	19,640	28,168	41,717	4,672	23,403
Chase	-71,066	-60,915	-69,198	-71,338	-77,346	-71,773
Coffey	8,314	17,822	35,335	21,761	-10,354	14,575
Douglas	36,320	32,402	47,274	28,868	1,755	29,524
Franklin	22,463	12,500	16,708	30,212	2,898	16,956
Geary	2,570	7,426	23,457	12,935	429	9,363
Johnson	34,080	40,050	51,071	39,907	19,158	36,853
Linn	17,938	20,866	36,004	27,917	7,198	21,985
Lyon	-11,597	13,414	20,185	12,410	-22,265	2,429
Miami	43,972	40,275	58,446	55,809	6,234	40,947
Morris	-7,449	20,174	15,102	3,120	-8,789	4,432
Osage	46,558	53,345	57,722	83,559	32,915	54,820
Shawnee	52,478	63,148	73,967	80,980	45,652	63,247
Wabaunsee	3,123	1,105	4,950	6,985	-16,180	-3
District Total	200,525	272,261	399,190	375,841	-14,022	246,759
Southeast:						
Allen	18,498	37,445	24,474	24,702	14,466	23,917
Bourbon	-3,229	24,650	16,042	15,437	3,109	11,242
Butler	-23,750	-15,627	12,713	-22,184	-62,868	-22,343
Chautauqua	-3,413	-2,446	-1,059	1,038	-3,848	-1,946
Cherokee	5,885	30,348	21,196	10,555	15,670	16,731
Cowley	-673	-11,462	-23,983	-28,041	-30,977	-19,027
Crawford	8,441	36,167	32,912	31,994	23,846	26,672
Elk	-10,715	-8,731	-9,219	-7,553	-7,902	-8,824
Greenwood	-11,446	-2,410	-3,349	-11,591	-8,863	-7,533
Lahette	-5,087	17,510	-5,242	-12,866	-20,295	-5,196
Montgomery	2,618	19,156	27,571	6,895	7,566	12,762
Neosho	102	24,924	19,156	17,674	8,138	13,999
Wilson	3,345	34,054	35,277	14,721	14,095	20,298
Woodson	-9,115	-5,163	-8,013	-2,954	-19,934	-9,037
District Total	-23,937	176,610	136,409	37,110	-67,002	91,714
State Total	1,064,601	2,233,524	2,429,008	2,693,742	1,475,708	2,199,430

^aAssume entire surplus or deficit was fed only to grain fed cattle.^bNumber of fed cattle that could have been fed during the feeding year.

Central, and Southeast Kansas were only slightly above equilibrium during 1966-71, with the Central district having to import feed for 1970-71 and the Southeast also importing feed for the 1966-67 and 1970-71 feeding years.

Only the Northwest, West Central, and Southwest districts had increases in potential expansion possibilities from 1969-70 to the 1970-71 feeding year. Northeast, West Central, and East Central districts showed decreases of over 350,000 head expansion potential for the same years.

County

Stevens county in the Southwest district, with 178,668 head, had the largest expansion potential for any one feeding year (i.e., 1970-71) and the 5 year average, (148,467 head) of all the counties. Barton county, (followed by Chase, Ford, and Butler) had the largest deficit situation--requiring the importation of enough grain to feed 81,679 head of cattle. Brown, Stanton, and Marshall counties all had large expansion potentials for 1966-71.

Downward trends in expansion potential were shown for Barton, Pratt, and Cowley counties during 1966-70. However, Thomas, Cloud, Meade, Morton, Osage, Shawnee, and Chautauqua counties went from deficit situations to positive expansion potential for the same time period. Stable levels of positive expansion potential were shown by Brown and Doniphan counties, while Kearny and Wyandotte, with lesser expansion potential, also showed stable grain fed cattle expansion potential. Clark and Chase counties showed relatively stable deficit positions.

Western Kansas counties, as a rule, had increases in expansion potential from 1969-70 to 1970-71. On one hand, with the exception

of Harper, Sumner, Cherokee, Greenwood, and Montgomery counties, Central and Eastern Kansas counties all experienced reductions in expansion potential between the two feeding years. Large increases took place in Wichita, Finney, Gray, and Haskell counties (all in Western Kansas).

HOG EXPANSION

State

Kansas, as a whole, averaged slightly less than 5.5 million head expansion potential for hogs during 1966-71 (Table 10). The average, however, was reduced substantially by reduced feed grain production in 1970-71. The expansion potential increased from 4.9 to nearly 7.0 million head between 1966-67 and 1969-70. Again, the dramatic influence of adverse weather and crop disease conditions on livestock expansion potential is shown for the 1970-71 feeding year.

Crop Reporting District

Southwest, North Central, Northeast, and East Central Kansas had expansion potential of over 1 million additional hogs during some feeding years between 1966-71. However, only the Southwest and Northeast districts showed consistent large expansion potential. Central, followed by the South Central and Southeast districts, showed the least expansion potential on the average. Large fluctuations in hog expansion potential occurred in North Central and East Central Kansas during the same time period. Both of these districts, plus the Northeast district, showed decreases from 1969-70 to 1970-71 of expansion potential of about 1 million head. This alone could account for the drop in the state hog expansion potential for those years. Western Kansas' districts all showed increases in expansion potential from 1969-70 to 1970-71.

Table 10.--Potential additional hog production, based on surplus (or deficit) feed grain availability by county, crop reporting district, and Kansas, feeding years 1966-1971 and 5 year average.^a

County, crop reporting district, and state	Feeding Year					5 year average
	1966-67	1967-68	1968-69	1969-70	1970-71	
	(number of head)					
Northwest:						
Cheyenne	61,340	42,429	87,459	89,603	99,657	76,593
Decatur	42,329	7,824	16,241	34,998	37,202	27,821
Graham	1,665	45	8,850	33,393	36,295	16,448
Norton	42,408	18,263	31,575	51,417	45,822	38,090
Rawlins	7,361	-10,633	5,015	3,100	44,337	10,136
Sheridan	783	32,601	26,848	37,910	83,786	36,894
Sherman	144,208	131,900	190,437	192,409	183,403	169,013
Thomas	44,452	51,641	78,490	114,110	131,727	84,947
District Total	344,548	274,979	444,915	556,938	662,230	439,942
West Central:						
Gove	-73,374	-80,699	-46,749	-37,269	-67,864	-60,829
Greeley	10,270	81,688	62,145	50,745	34,451	47,809
Lane	-7,025	11,550	14,409	838	26,036	9,301
Logan	5,243	-6,932	32,478	22,884	31,312	17,631
Ness	-8,096	1,495	1,246	16,635	15,551	5,613
Scott	88,420	39,546	102,617	1,717	49,361	55,829
Trego	5,089	1,707	22,292	6,822	13,667	11,022
Wallace	59,941	97,637	107,608	98,162	133,283	99,532
Wichita	211,222	230,992	186,139	165,724	259,519	208,773
District Total	292,463	377,885	482,106	326,455	491,820	394,941
Southwest:						
Clark	-17,382	-23,926	-15,551	-20,355	-15,539	-13,501
Finney	119,237	67,139	50,923	45,213	162,394	89,394
Ford	-131,115	-146,796	-183,231	-175,275	-178,756	-164,433
Grant	224,796	282,174	167,779	275,497	236,816	237,040
Gray	91,140	65,668	45,010	63,974	139,714	93,651
Hamilton	58,062	82,079	63,288	83,816	71,527	72,797
Haskell	214,406	257,265	162,676	158,473	265,377	213,144
Hodgeman	9,514	9,225	9,583	-713	-3,982	1,016
Kearny	84,036	62,571	75,158	62,547	6,597	61,562
Meade	-10,074	32,039	37,463	78,275	70,657	42,432
Morton	154,026	219,378	219,710	254,958	210,369	212,176
Seward	92,764	111,295	93,099	30,465	73,627	83,811
Stanton	245,149	332,499	289,769	258,122	305,980	288,563
Stevens	379,841	336,650	317,455	422,603	445,778	381,076
District Total	1,528,155	1,688,868	1,343,630	1,538,133	1,840,457	1,597,892
North Central:						
Clay	-7,155	69,713	55,007	79,543	37,864	47,315
Cloud	87,682	105,255	117,943	155,804	114,868	116,720
Jewell	76,737	24,456	52,067	123,176	7,329	35,984
Mitchell	8,960	30,183	20,623	59,210	-20,271	17,877
Osborne	5,427	28,893	2,739	42,275	10,675	18,076
Ottawa	-10,824	-13,571	-639	3,060	924	-4,028
Phillips	53,911	16,522	13,109	51,018	3,932	27,952
Republic	164,236	244,662	277,381	268,637	59,964	202,467
Rooks	-5,081	4,153	2,981	-3,238	-11,892	-2,693
Smith	61,331	34,036	30,611	56,515	-24,222	31,245
Washington	72,907	76,293	58,501	278,110	28,046	103,811
District Total	510,127	629,505	630,584	1,105,111	207,234	615,436
Central:						
Barton	-23,781	-30,620	-106,501	-184,048	-203,790	-115,598
Dickinson	-27,081	2,310	52,605	39,080	7,253	15,317
Ellis	4,584	5,333	-59,348	-25,397	-46,010	-24,686
Ellsworth	8,115	-1,861	-7,416	16,395	-1,966	2,678
Lincoln	-22,822	-20,217	-20,411	-8,485	-19,806	-18,249
McPherson	27,251	29,017	52,995	72,384	34,631	43,658
Marion	44,643	71,550	30,897	39,591	19,475	49,039
Rice	83,544	45,951	18,749	61,868	31,515	48,029
Rush	18,866	18,297	18,530	46,367	22,645	25,123
Russell	2,779	7,573	-4,782	14,222	5,906	5,221
Saline	-3,589	-1,049	26,292	7,565	3,297	6,625
District Total	112,720	106,265	51,651	71,040	-146,790	37,156

Table 10.--Continued

South Central:						
Barber	-5,960	-16,450	-12,780	17,848	8,333	-1,517
Comanche	-3,548	1,163	-7,432	-10,705	-11,631	-6,550
Edwards	19,705	29,159	8,956	8,006	2,886	13,493
Harper	-14,374	-32,546	-23,783	-12,798	-8,573	-18,254
Harvey	26,968	38,966	61,171	51,689	-18,832	31,811
Kingman	-17,355	-27,924	-12,924	10,727	-29,577	-15,238
Kiowa	-17,707	-3,788	-5,367	4,517	6,024	-3,063
Pawnee	2,539	41,637	-19,318	30,603	15,503	14,143
Pratt	-50,607	-60,565	-80,395	-102,721	-111,066	-83,461
Reno	80,276	21,760	32,921	95,255	55,202	57,311
Sedgwick	26,645	12,760	58,558	62,295	5,816	33,408
Stafford	46,469	42,975	38,684	104,651	72,810	61,590
Sumner	14,369	-30,161	6,327	46,194	49,627	17,932
District Total	107,420	16,937	35,604	305,561	36,525	101,655
Northeast:						
Atchison	151,463	99,161	186,899	150,731	65,052	130,447
Brown	322,828	372,333	336,319	356,495	165,449	399,066
Doniphan	255,660	265,499	248,480	248,367	208,252	244,712
Jackson	115,541	112,694	175,971	126,756	37,158	113,286
Jefferson	154,255	125,166	204,913	139,088	71,044	138,475
Leavenworth	63,074	46,178	73,056	59,200	59,152	58,318
Marshall	276,626	266,554	294,245	311,144	122,884	253,519
Nemaha	185,365	186,781	217,957	154,535	58,050	159,538
Pottawatomie	56,945	99,648	45,079	77,124	9,691	57,214
Riley	8,263	54,926	48,441	97,312	4,098	42,943
Wyandotte	6,631	17,233	9,663	14,204	2,760	10,064
District Total	1,596,649	1,646,437	1,843,043	1,735,574	794,569	1,518,388
East Central:						
Anderson	60,563	52,123	71,931	104,984	11,657	60,070
Chase	-188,603	-185,550	-176,797	-177,990	-192,978	-184,221
Coffey	22,064	47,297	90,233	54,293	-25,834	37,411
Douglas	96,391	85,994	120,719	74,521	4,379	75,760
Franklin	59,616	33,174	42,666	75,379	7,230	43,522
Geary	6,822	19,707	59,900	32,273	1,070	24,033
Johnson	90,446	106,289	139,417	99,569	47,798	94,592
Linn	47,695	55,378	91,941	69,653	17,960	56,429
Lyon	-30,777	35,601	51,544	30,962	-55,551	6,236
Miami	116,699	106,887	149,248	139,244	15,555	105,101
Morris	-19,769	53,539	38,566	7,784	-21,928	11,375
Osage	123,563	141,573	147,399	208,481	82,124	140,708
Shawnee	139,272	167,616	188,585	202,046	113,992	162,338
Wabaunsee	8,289	2,932	12,641	17,427	-40,269	-9
District Total	532,178	722,561	1,019,381	937,727	-34,986	633,364
Southeast:						
Allen	49,091	99,376	62,498	61,321	36,094	61,389
Bourbon	-8,569	65,949	40,964	38,515	7,756	28,854
Butler	-63,030	-41,473	32,464	-55,349	-156,856	-57,349
Chautauqua	-9,057	-6,490	-2,705	2,589	-9,601	-4,994
Cherokee	-15,618	80,541	54,127	26,335	89,096	42,943
Cowley	-1,786	-30,420	-61,244	-69,962	-77,287	-48,838
Crawford	22,401	95,985	84,045	79,824	49,495	68,460
Elk	-28,437	-23,172	-23,542	-18,844	-19,715	-22,649
Greenwood	-30,376	-6,397	-8,552	-28,920	-22,128	-19,335
Labette	-13,501	46,469	-13,387	-32,102	-50,637	-13,330
Montgomery	6,949	50,345	70,407	17,204	18,876	32,756
Neosho	272	66,147	48,917	44,998	20,305	35,932
Wilson	8,877	90,378	90,384	36,729	35,163	52,101
Woodson	-24,191	-13,793	-20,476	-7,371	-49,737	-23,196
District Total	-75,735	474,934	353,598	94,375	-169,168	132,737
State Total	4,948,518	5,927,612	6,294,310	6,720,914	3,681,905	5,491,567

^aAssumes entire surplus or deficit was fed only to hogs.

County

Stevens county, with 445,778 head, had the largest expansion potential for a single year, while Barton county showed a deficit i.e., need to import feed for about 204 thousand head. Other counties, such as, Stanton, Brown, and Marshall also had large expansion potentials. Chase, Ford, and Pratt counties had to import large quantities of feed. Chase county showed a consistent level of expansion, while Pratt, Barton, and Ford counties had somewhat decreasing trends away from equilibrium expansion. Finney and Kearny counties also showed declining trends. However, Meade, Morton, Cloud, Cheyenne, and Thomas counties all showed upward trends.

Counties declining in expansion potential for hogs occurred mostly in the Central and Eastern sections of Kansas, while Western counties generally increased from 1969-70 to 1970-71.

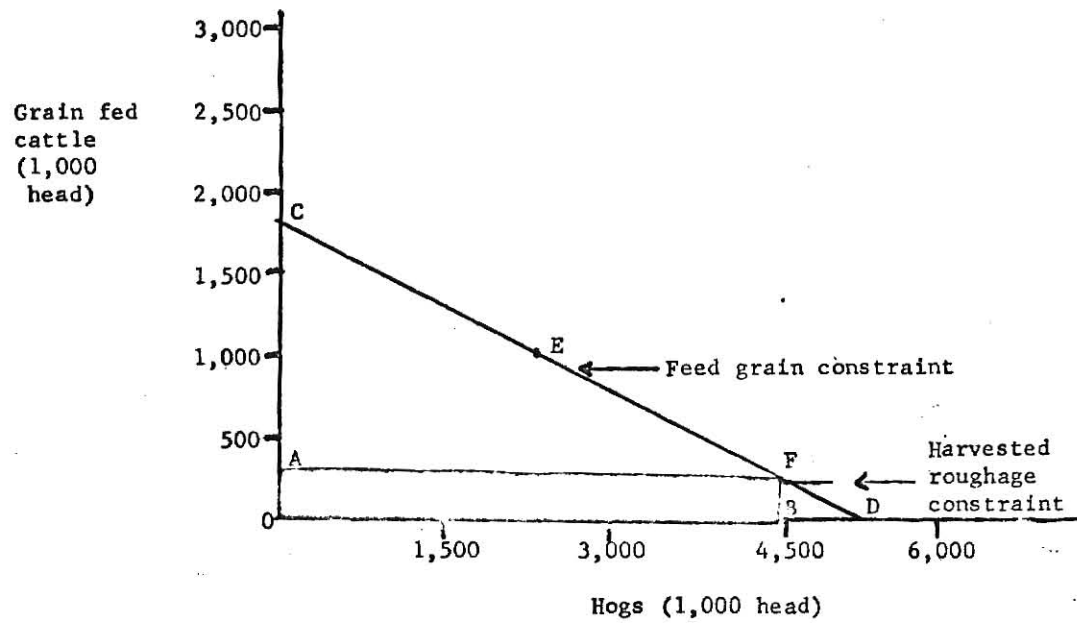
Possible Combinations of Livestock

In arriving at a realistic expansion of livestock, it is necessary to look at more than the maximum number of only one class at a time. It is probable that expansion will occur simultaneously in two or more classes. To illustrate this, concurrent expansion possibilities were calculated for hogs and grain fed cattle. This assumes only one input, feed grains, to be divided between the production of grain fed cattle and hogs. For each year the state surplus of feed grains was known. The more feed grains that are available, the more hogs and/or grain fed cattle that can be fed. The substitution possibilities for grain fed cattle and hogs was assumed to be linear. With this basic relationship, the iso-product curve is also linear, indicating a constant

rate of substitution for grain fed cattle and hogs. Modifying this, however, is the fact that grain fed cattle production may also be limited by availability of harvested roughages.

Figure 6 illustrates the substitution possibilities for 1966-67. Ignoring for the moment the harvested roughage constraint, the chart shows that slightly more than 1.8 million cattle, point C, or about 5.0 million hogs, point D, could have been fed out. The diagonal line CD indicates the various combinations of cattle and hogs that could have been produced. For example, point E shows that an additional 1.0 million cattle and 2.2 million hogs could have been produced. However, the expansion of cattle feeding in 1966-67 would have been limited to about 273,000 head on the basis of availability of harvested roughages. With the roughage constraint the production possibilities would have been limited to FD. At any fed cattle production of less than 200,000 head some roughage surplus would have remained. At only one point, i.e., F, would the entire balance of both roughage and feed grains have been utilized. This would have produced an additional 200,000 head of fed cattle and an additional 4,400,000 head of hogs. The indicated constraint of roughage on fed cattle production probably is more apparent than real. It is a normal management practice to produce only the approximate silage requirements each year. In view of low value relative to weight and bulk, silage is not economically marketable beyond the immediate locality of production. Where cattle feeding has expanded, silage production has increased to meet requirements. Thus, in all likelihood, if cattle production had expanded beyond the indicated 200,000 head, silage production would have increased to meet requirements. Local deficits of hay can be met by importation from areas of surplus.

Fig. 6.--Possible combinations of additional grain fed cattle and hog production, as limited by harvested roughages, Kansas, feeding year 1966-67.



A--272,958 grain fed cattle (as limited by harvested roughages)

B--4,224,108 hogs

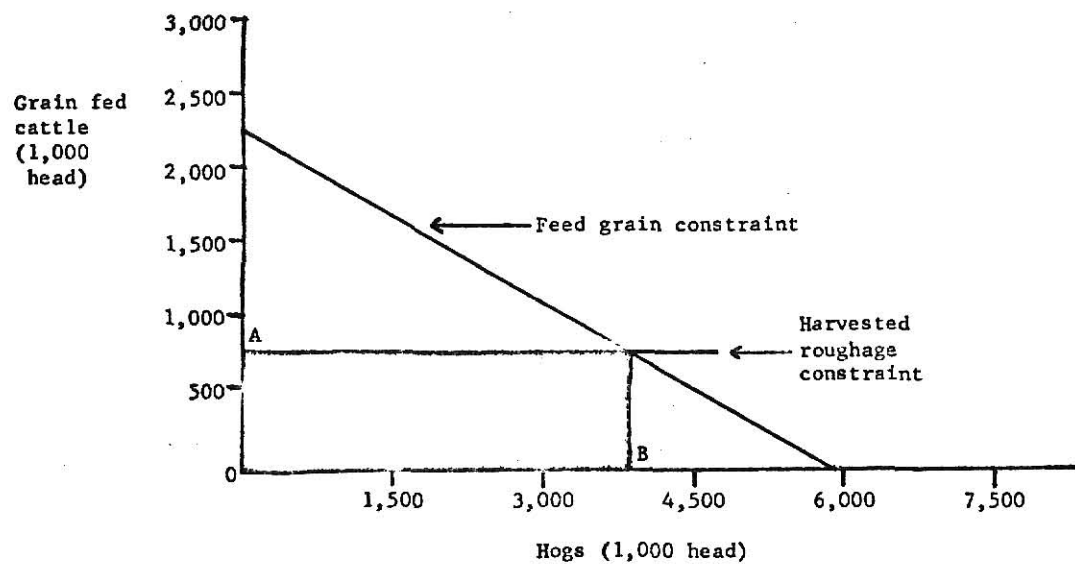
Figures 7 through 11 show possible combinations of grain fed cattle and hogs for each feeding year of the 1967-71 period and the 5 year average--with the constraint imposed on cattle feeding by the availability of harvested roughages in those feeding years.

With the exception of 1970-71, all feeding years show a substantial potential expansion in grain fed cattle and hog production. Disregarding the constraint by harvested roughages, grain fed cattle maximum expansion was about 1,500,000 extra head or about 3,700,000 more hogs that could have been fed (Figure 10) in Kansas, as a whole, in the 1970-71 feeding year. The possible expansion of both species lies somewhere between these two extremes.

Imposing the constraint of harvested roughages, the number of grain fed cattle could have been increased by, at least, 270,000 head (1970-71 excluded) over and above livestock production for the 1966-67 feeding year. In 1970-71, harvested roughage balance was -1,130,000 tons, meaning that this amount of roughages was imported to support livestock produced in 1970-71. In terms of grain fed cattle, this would be -502,361 head.¹ Deficit harvested roughage balances for the state would suggest that grain importation in 1970-71 was required for 502,361 head. Production of grain fed cattle increased by 97,000 head during that year. The expansion might have been even greater had a surplus existed. It is apparent that deficits of feed grains and harvested roughages are not absolute restrictions.

¹State total from Table E-1, Appendix E.

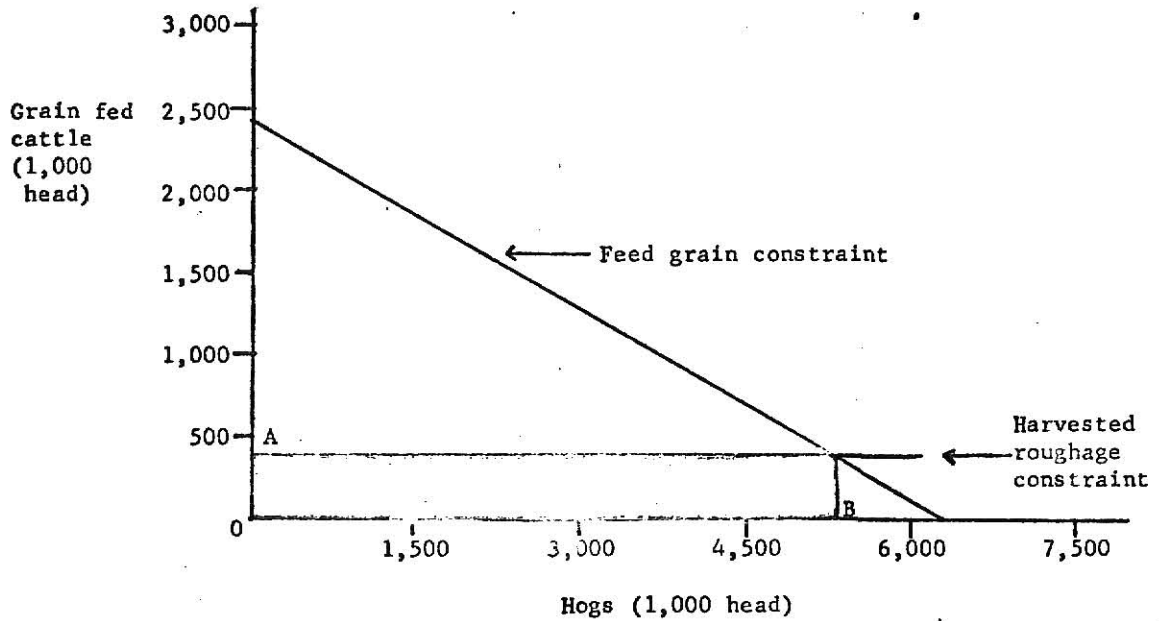
Fig. 7.--Possible combinations of additional grain fed cattle and hog production, limited by harvested roughages, Kansas, feeding year 1967-68.



A--788,292 grain fed cattle (as limited by harvested roughages)

B--3,835,541 hogs

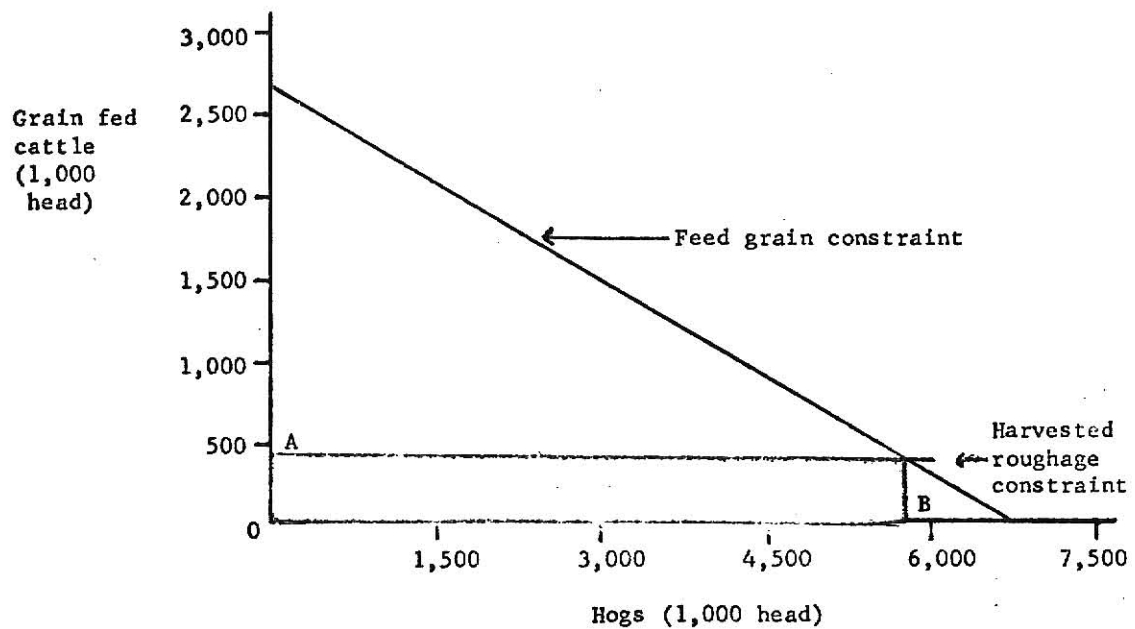
Fig. 8.--Possible combinations of additional grain fed cattle and hog production, as limited by harvested roughages, Kansas, feeding year 1968-69.



A--383,584 grain fed cattle (as limited by harvested roughages)

B--5,224,780 hogs

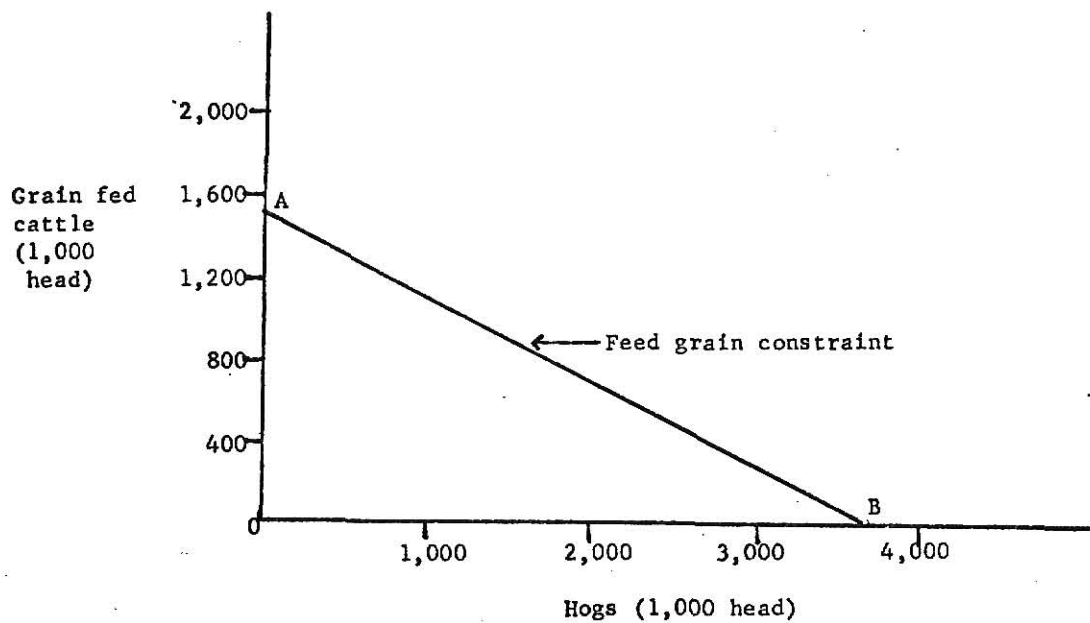
Fig. 9.--Possible combinations of additional grain fed cattle and hog production, as limited by harvested roughages, Kansas, feeding year 1969-70.



A--409,599 grain fed cattle (as limited by harvested roughages)

B--5,710,360 hogs

Fig. 10.--Possible combinations of additional grain fed cattle and hog production, as limited by feed grains, Kansas, feeding year 1970-71.^a

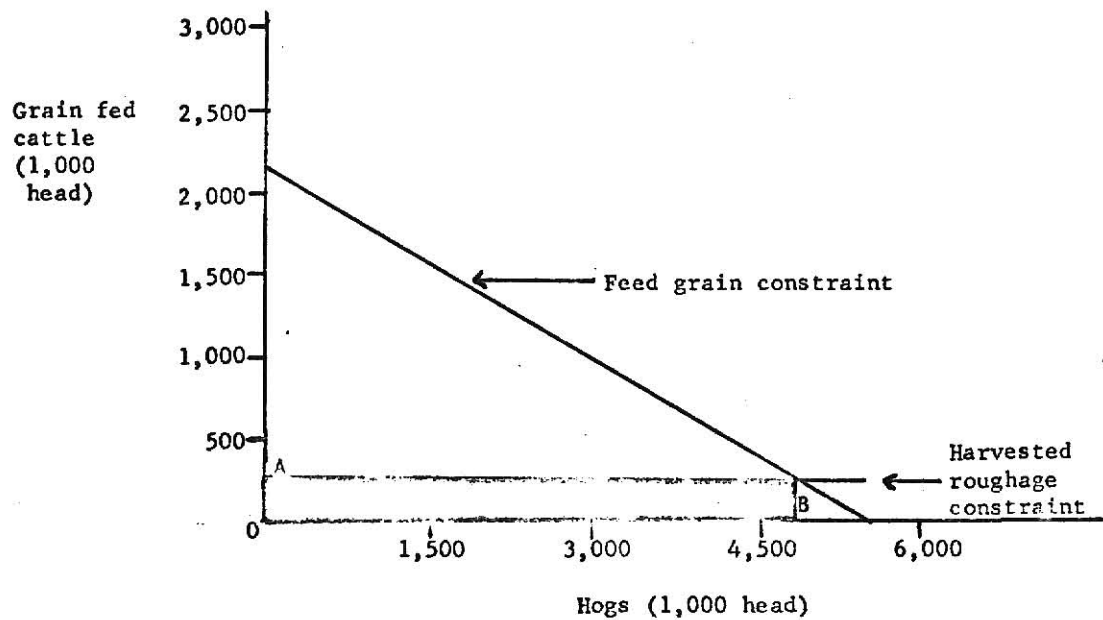


A--1,475,708 grain fed cattle (as limited by feed grain surplus)

B--3,681,906 hogs

^a Harvested roughage balance for 1970-71 was negative--requiring importation of roughage requirements for about 502,361 head of grain fed cattle.

Fig. 11.--Possible combinations of additional grain fed cattle and hog production, as limited by harvested roughages, Kansas, 5 year average.



A--270,414 grain fed cattle (as limited by harvested roughages)

B--4,802,217 hogs

Feeding Wheat

Wheat has at times been, and possibly in the future, will be a potentially large source of livestock feed. Feeding trials and considerable feedlot experience show that wheat is a satisfactory livestock feed. Experiences during the years 1966-71 indicate that whether wheat will be fed is primarily a matter of relative prices. Wheat is fed when its price, relative to corn and grain sorghum, is such as to make it a cheaper feed.

To determine the possible impact of feeding wheat in Kansas during 1966-69, it was assumed that 20 percent of wheat production was available for each county, crop reporting district, and Kansas. Also, it was assumed that the greatest amount of wheat contained in a ration for grain fed cattle was 50 percent of the total ration. With hogs, however, it was assumed that wheat could make up the entire ration.

Each county's wheat production was multiplied by 20 percent (i.e., .20) and then checked to see if that amount was less than feed grain production in that county. As long as 20 percent of the wheat crop did not exceed feed grain production, it would satisfy the feeding ration limitations. If the 20 percent of wheat production was greater than the feed grain production, subtraction of the excess from feed grain production was done in order to meet the ration requirements.

Each county's feed grain and wheat production was then divided by feed grain consumption per grain fed cattle and hog to determine the maximum additional numbers that could have been fed. Tables 11 and 12 show the number of grain fed cattle and hogs that could have been fed in addition to already calculated surpluses and deficits of feed

Table 11.— Additional grain fed cattle that could have been fed from 20 percent of wheat production by county, crop reporting district, and Kansas, feeding years 1966-70.

County, crop reporting district, and state	Feeding Year			
	1966-67	1967-68	1968-69	1969-70
	(in number of head)			
Northwest:				
Cheyenne	15,600	19,469	12,413	17,822
Decatur	11,150	15,725	11,760	14,832
Graham	9,221	13,728	11,011	14,275
Norton	9,715	13,680	13,862	15,206
Rawlins	16,013	20,592	13,670	18,955
Sheridan	11,232	14,256	10,968	15,442
Sherman	21,091	19,051	6,062	24,163
Thomas	24,422	21,614	10,920	28,008
District Total	118,444	138,115	90,666	144,203
West Central				
Gove	5,597	18,274	5,486	18,542
Greeley	8,861	2,870	514	17,947
Lane	7,027	14,150	3,998	19,459
Logan	8,174	13,800	4,378	16,661
Ness	8,016	12,163	7,066	27,850
Scott	10,526	17,280	5,779	19,382
Trego	4,800	13,406	4,704	14,726
Wallace	5,688	5,914	806	8,674
Wichita	7,862	10,368	2,266	17,218
District Total	66,551	108,225	34,997	160,459
Southwest:				
Clark	6,384	6,682	4,973	12,888
Finney	13,037	15,178	9,629	33,389
Ford	18,000	17,707	15,883	36,912
Grant	6,998	8,971	2,784	12,931
Gray	12,163	12,566	8,098	26,088
Hamilton	10,886	5,386	2,400	16,795
Haskell	7,613	8,424	6,528	19,517
Hodgeman	7,776	8,870	5,616	20,381
Kearny	8,064	4,555	1,968	11,400
Meade	8,237	10,512	6,730	18,802
Morton	3,696	2,059	1,284	4,795
Seward	6,605	5,040	3,384	12,034
Stanton	11,309	4,320	3,346	12,634
Stevens	7,219	10,176	5,659	11,938
District total	127,987	120,446	78,232	250,506
North Central:				
Clay	9,398	11,933	15,576	13,901
Cloud	14,170	14,784	19,944	19,997
Jewell	10,560	15,437	19,133	19,142
Mitchell	15,648	18,144	21,912	24,384
Osborne	9,062	10,982	13,066	17,280
Ottawa	14,256	13,954	22,848	20,750
Phillips	9,715	10,181	10,819	12,749
Republic	9,187	13,354	16,589	14,390
Rooks	8,496	11,098	12,096	15,552
Smith	11,635	9,485	16,085	16,805
Washington	10,109	13,478	18,010	14,232
District total	122,236	142,830	186,078	189,182
Central:				
Barton	13,104	22,435	21,566	28,066
Dickinson	18,278	14,227	27,053	20,246
Ellis	5,141	7,392	12,254	17,813
Ellsworth	6,408	14,131	13,565	14,294
Lincoln	8,371	7,325	14,458	16,080
McPherson	20,486	21,706	35,290	24,864
Marion	14,462	10,445	23,650	13,882
Rice	17,395	19,536	24,600	23,914
Rush	6,864	9,101	13,951	19,157
Russell	6,547	11,304	15,499	20,002
Saline	14,352	11,578	22,238	18,763
District total	131,408	149,130	223,224	217,081
South Central:				
Barber	14,170	11,290	18,720	18,192
Comanche	5,976	6,182	5,918	12,096

Table 11.-- Continued

Edwards	9,907	11,837	11,208	18,710
Harper	24,883	13,978	37,675	31,320
Harvey	12,960	2,808	20,381	15,274
Kingman	19,536	14,112	32,227	29,002
Kiowa	8,731	9,331	8,376	14,885
Pawnee	13,608	17,366	14,582	24,192
Pratt	14,429	21,120	17,755	23,122
Reno	30,518	30,720	47,520	46,622
Sedgwick	23,280	10,685	39,086	31,349
Stafford	14,688	19,747	19,267	24,509
Sumner	39,600	31,104	55,382	55,536
District total	232,286	200,280	328,097	344,809
Northeast:				
Atchison	2,880	3,341	4,147	2,645
Brown	4,570	5,290	6,912	3,720
Doniphan	1,958	2,304	2,822	1,670
Jackson	4,435	4,320	5,208	2,760
Jefferson	2,746	3,360	3,974	2,040
Leavenworth	2,227	2,621	2,774	1,440
Marshall	9,542	11,794	14,030	11,088
Nemaha	4,733	5,184	6,365	4,435
Pottawatomie	4,454	5,054	6,394	4,464
Riley	4,406	4,925	5,861	4,406
Wyandotte	461	360	518	446
District total	42,412	48,553	59,405	39,114
East Central:				
Anderson	3,629	4,570	4,867	3,168
Chase	2,462	1,632	3,110	1,685
Coffey	3,370	4,277	4,032	2,645
Douglas	3,600	4,118	4,200	2,923
Franklin	3,168	3,456	3,974	2,678
Geary	4,037	4,032	5,040	3,120
Johnson	2,611	2,496	2,688	2,083
Linn	3,202	3,758	4,262	2,530
Lyon	3,994	3,974	4,915	3,110
Miami	3,379	3,480	4,493	2,645
Morris	5,779	5,597	7,560	4,618
Osage	3,720	4,118	4,368	2,592
Shawnee	4,464	4,536	5,059	3,360
Wabaunsee	3,062	3,360	3,917	2,688
District total	50,477	53,404	61,385	39,845
Southeast:				
Allen	3,370	4,406	4,118	2,976
Bourbon	2,462	3,110	3,485	2,040
Butler	7,838	3,744	14,366	7,200
Chautauqua	1,382	4,013	3,648	1,872
Cherokee	9,072	11,376	10,565	8,909
Cowley	13,018	19,070	18,898	17,741
Crowford	5,184	7,128	5,702	4,315
Elk	1,382	3,226	2,530	2,016
Greenwood	1,824	2,722	3,101	1,560
Labette	6,600	11,405	8,928	6,912
Montgomery	5,107	11,928	8,755	6,758
Neosho	5,741	8,482	7,507	4,896
Wilson	4,013	9,629	7,670	4,320
Woodson	1,536	2,506	2,352	1,320
District total	68,529	102,744	106,625	72,835
State Total	960,330	1,063,727	1,168,759	1,458,034

*District totals may not sum exactly due to rounding.

Table 12.--Additional number of hogs that could have been fed 20 percent of wheat production by county, crop reporting district, and Kansas feeding years 1966-70.

County, crop reporting district and state	Feeding Years			
	1966-67	1967-68	1968-69	1969-70
	(number of head)			
Northwest:				
Cheyenne	41,401	51,669	31,698	44,511
Decatur	29,592	41,732	30,031	37,043
Graham	24,471	36,433	28,118	35,652
Norton	25,783	36,306	35,399	37,978
Rawlins	42,497	54,650	34,909	47,341
Sheridan	29,809	37,834	28,008	38,565
Sherman	55,975	50,560	15,481	60,348
Thomas	64,815	57,263	27,886	69,950
District total	314,343	366,547	231,530	371,388
West Central:				
Gove	14,853	48,497	14,010	46,310
Greeley	23,516	7,618	1,317	44,823
Lane	18,650	37,554	10,210	48,599
Logan	21,694	36,624	11,179	41,610
Ness	21,274	32,280	18,043	69,554
Scott	27,936	45,860	14,758	48,408
Trego	12,739	35,580	12,012	36,779
Wallace	15,096	15,694	2,059	21,662
Wichita	20,866	27,516	5,785	43,001
District total	176,624	287,223	89,368	400,746
Southwest:				
Clark	16,943	17,732	12,699	32,188
Finney	34,599	40,280	24,588	83,389
Ford	47,771	46,994	40,560	92,188
Grant	18,573	23,809	7,109	32,296
Gray	32,280	33,350	20,678	65,155
Hamilton	28,892	14,293	6,129	41,946
Haskell	20,204	22,357	16,670	48,743
Hodgeman	20,637	23,541	14,341	50,901
Kearny	21,401	12,089	5,026	28,472
Meade	21,860	27,898	17,185	46,957
Morton	9,809	5,465	3,285	11,976
Seward	17,529	13,376	8,641	30,054
Stanton	30,013	11,465	8,543	31,552
Stevens	19,159	27,006	14,451	29,814
District total	339,670	319,655	199,905	625,531
North Central:				
Clay	24,943	31,669	39,775	34,717
Cloud	37,605	39,236	50,930	49,942
Jewell	28,025	40,968	48,858	47,808
Mitchell	41,529	48,153	55,955	60,899
Osborne	24,051	29,146	33,365	43,157
Ottawa	37,834	37,032	58,345	51,824
Phillips	25,783	27,019	27,628	31,840
Republic	24,382	35,439	42,362	35,940
Rooks	22,548	29,452	30,889	38,841
Smith	30,879	25,172	41,075	41,970
Washington	26,828	35,771	45,990	35,544
District total	324,407	379,057	475,172	429,325
Central:				
Barton	34,777	59,541	55,072	70,094
Dickinson	48,510	37,758	69,083	50,565
Ellis	13,643	19,618	31,293	44,488
Ellsworth	17,006	37,503	34,639	35,700
Lincoln	22,217	19,439	36,919	40,160
McPherson	54,369	57,605	90,116	62,098
Marion	38,382	27,720	60,392	34,669
Rice	46,166	51,847	62,819	59,724
Rush	18,217	24,153	33,328	47,844
Russell	17,376	30,000	39,579	49,954
Saline	38,089	30,726	56,789	46,861
District total	348,752	395,610	570,029	542,457

Table 12.-- Continued

South Central:				
Barber	37,605	29,962	47,804	45,435
Comanche	15,860	16,408	15,113	30,210
Edwards	26,293	31,414	28,621	46,729
Harper	66,038	37,096	96,208	78,222
Harvey	34,395	7,452	52,045	38,146
Kingman	51,847	37,452	82,296	72,432
Kiowa	23,172	24,764	21,389	37,175
Pawnee	36,115	46,089	37,238	60,420
Pratt	38,293	56,051	45,340	57,746
Reno	80,994	81,529	121,348	116,440
Sedgwick	61,783	28,357	99,812	78,294
Stafford	38,981	52,408	49,201	61,211
Sumner	105,095	82,546	141,426	146,194
District total	616,471	531,530	837,841	868,654
Northeast:				
Atchison	7,643	8,866	10,590	6,605
Brown	12,127	14,038	17,651	9,291
Doniphan	5,197	6,115	7,207	4,172
Fackson	11,771	11,465	13,299	6,893
Jefferson	7,287	8,917	10,149	5,095
Leavenworth	5,911	6,955	7,085	3,596
Marshall	25,325	31,299	35,828	27,692
Nemaha	12,561	13,758	16,253	11,077
Pottawatomie	11,822	13,414	16,327	11,149
Riley	11,694	13,070	14,966	11,005
Wyandotte	1,223	955	1,324	1,115
District total	112,561	128,852	150,679	97,780
East Central				
Anderson	9,631	12,127	12,429	7,912
Chase	6,535	4,331	7,943	4,208
Coffey	8,943	11,350	10,296	6,605
Douglas	9,554	10,930	10,725	7,301
Franklin	8,408	9,172	10,149	6,689
Geary	10,713	10,701	12,870	7,792
Johnson	6,930	6,624	6,864	5,203
Linn	8,497	9,975	10,885	6,318
Lyon	10,599	10,548	12,552	7,768
Miami	8,968	9,236	11,473	6,605
Morris	15,338	14,853	19,305	11,532
Osage	9,873	10,930	11,154	6,474
Shawnee	11,847	12,038	12,919	8,392
Wabaunsee	8,127	8,917	10,002	6,713
District total	133,963	141,732	159,566	99,512
Southeast:				
Allen	8,943	11,694	10,517	7,433
Bourbon	6,535	8,255	8,839	5,095
Butler	20,803	9,936	36,686	17,982
Chautauqua	3,669	10,650	9,316	4,675
Cherokee	24,076	30,191	26,979	22,250
Cowley	34,548	50,611	48,257	44,308
Crawford	13,758	18,917	14,562	10,777
Elk	3,669	8,561	6,460	5,035
Greenwood	4,841	7,223	7,918	3,896
Labette	17,516	30,268	22,799	17,263
Montgomery	13,554	31,656	22,358	16,879
Neosho	15,236	22,510	19,171	12,228
Wilson	10,650	25,554	19,587	10,789
Woodson	4,076	6,650	6,006	3,297
District total	181,874	272,676	259,515	181,907
State	2,548,665	2,822,882	2,973,605	3,617,300

*Totals may not sum exactly due to rounding.

grains by assuming 20 percent of wheat production during 1966-69 was fed.

All counties could have increased livestock production by the addition of wheat. Hodgeman, Comanche, Harper, Lincoln, Ottawa, and Rooks counties became surplus rather than deficit feed grain areas when wheat was included as a source of feed.

From year to year, about 1 million to almost 2 million more grain fed cattle could have been supported from this additional feed for Kansas as a whole. This represents at least a 50 percent increase in the maximum additional number of grain fed cattle for Kansas.

Hog production could have increased an additional 2.5 million in 1966-67 and 3.6 million in 1969-70 over and above production for those years which could have resulted from surpluses of feed grains.

CHAPTER IV

SUMMARY

There are some limitations to this study. Although surpluses of feed grains and harvested roughages were calculated, this does not mean that they could have been fed out entirely or perhaps even partly for a particular feeding year. Existing operators in the livestock industry may not have been able to expand their operations sufficiently to absorb the surpluses in one year, nor could new entrants necessarily begin operations in such a short period.

A location decision by livestock producers may be more influenced by factors other than the availability of surplus feed grains or harvested roughages. Available facilities, opposition to pollution, or distance from markets may influence a producer's decision of where to locate, even though there exists higher costs of procuring needed feed grains or harvested roughages in that area.

Livestock producers who depend on young animals that can only come from other livestock producers or their own brood stock need time to expand their operations. Costs of procurement may rise rapidly or inability to increase brood stock may limit expansion.

Counties, crop reporting districts, or Kansas cannot realistically be considered as closed systems. Buying, selling, and transporting feed grains and harvested roughages occurs between areas. Deficits of feed grains or harvested roughages in an area may be satisfied by reducing livestock numbers or purchasing inputs from areas with surpluses.

Variations in feeding value among feed grains and harvested roughages are expected. Such feeds have different grades, digestable protein, total digestable nutrients, etc. To aggregate these feeds into two classifications is only approximate.

Implications

Kansas had a favorable position as shown by surpluses of feed grains during 1966-71. Assuming that there are adequate quantities of other variables, Kansas has a potential for substantial expansion of its largest business, livestock. More livestock and more associated business all point to larger revenues for Kansas' agricultural sector.

During 1966-71, Kansas not only had a surplus of feed grains, but the surpluses increased by over 1.0 million tons. During this period, grain producers increased their output faster than did utilization by livestock producers.

SELECTED BIBLIOGRAPHY

Government Documents

Kansas State Board of Agriculture, Farm Facts Topeka, Kansas: State Printers Office, 1953-71.

United States Department of Agriculture, Agricultural Statistics Washington, D.C.: Government Printing Office, 1953-71.

_____. Economic Research Service, Milk Production. Washington, D.C.: Government Printing Office, November, 1968.

_____. Economic Research Service, Wheat Situation. Washington, D.C.: Government Printing Office, 1962-72.

Bulletins and Reports

Allen, G. C., and M. Devers, National and State Livestock-Feed Relationships Statistical Bulletin No. 446, Washington, D.C.: Government Printing Office, 1970.

Allen, G. C., and E. F. Hodges, National and State Livestock-Feed Relationships Supplement to Statistical Bulletin No. 446 for 1970, Washington D.C.: Government Printing Office, 1970.

Allen, G. C., and E. F. Hodges, Feed Consumed by Various Classes of Livestock by States, 1949-50 and 1959-60 Statistical Bulletin No. 379, Washington D.C.: Government Printing Office, 1966.

Emerson, M. J. et al, The Interindustry Structure of the Kansas Economy Kansas Department of Economic Development, Report No. 21, Manhattan, Kansas, January, 1969.

APPENDIX A

GRAIN-CONSUMING ANIMAL UNIT FACTORS

Grain-consuming animal unit factors are found by dividing the average consumption per head per year for each class of livestock in Kansas by the average consumption per dairy cow in the United States per year. With the exception of grain fed cattle, average consumption per head per year are for 1959-60. Calculation of grain consuming animal unit factor for various livestock in Kansas:

dairy cows	=	$\frac{\text{average consumption of concentrates fed per year to Kansas dairy cow}}{\text{average consumption of concentrates fed per year to U.S. dairy cow}}$
0.9475	=	$\frac{2364 \text{ pounds}}{2495 \text{ pounds}}$
"other" dairy cattle	=	$\frac{\text{average consumption of concentrates fed per year to Kansas other dairy cattle}}{\text{average consumption of concentrates fed per year to U.S. dairy cow}}$
0.2204	=	$\frac{550 \text{ pounds}}{2495 \text{ pounds}}$
grain fed cattle	=	$\frac{\text{average consumption of concentrates fed per year to cattle on feed in Kansas}}{\text{average consumption of concentrates fed per year to U.S. dairy cow}}$
1.9968	=	$\frac{4982 \text{ pounds}}{2495 \text{ pounds}}$

"other" beef	=	average consumption of concentrates fed per year to other beef cattle in Kansas average consumption of concentrates fed per year to U.S. dairy cow
0.0770	=	<u>192 pounds</u> 2495 pounds
hogs	=	average consumption of concentrates per year for hogs fed in Kansas average consumption of concentrates fed per year to U.S. dairy cow
0.4168	=	<u>1040 pounds</u> 2495 pounds
hens and pullets	=	average consumption of concentrates fed per year for hen and pullet in Kansas average consumption of concentrates fed per year to U.S. dairy cow
0.0369	=	<u>92 pounds</u> 2495 pounds
chickens	=	average consumption of concentrates fed per year to chickens raised in Kansas average consumption of concentrates fed per year to U.S. dairy cow
0.0088	=	<u>22 pounds</u> 2495 pounds
turkeys	=	average consumption of concentrates fed per year to turkeys raised in Kansas average consumption of concentrates fed per year to U.S. dairy cow
0.0365	=	<u>88 pounds</u> 2495 pounds
stock sheep	=	average consumption of concentrates fed per year to stock sheep in Kansas average consumption of concentrates fed per year to U.S. dairy cow
0.0585	=	<u>146 pounds</u> 2495 pounds

sheep on feed =
$$\frac{\text{average consumption of concentrates fed per year to sheep on feed in Kansas}}{\text{average consumption of concentrates fed per year to U.S. dairy cow}}$$

0.0549 =
$$\frac{137 \text{ pounds}}{2495 \text{ pounds}}$$

APPENDIX B

ROUGHAGE-CONSUMING ANIMAL UNIT FACTORS

Roughage-consuming animal unit factors are found in a similar manner as grain-consuming animal units. The following are for selected classes of livestock:

dairy cows	=	$\frac{\text{average consumption of harvested roughages per Kansas dairy cow}}{\text{average consumption of harvested roughages per U.S. dairy cow}}$
1.0000	=	$\frac{4.1 \text{ tons per year}}{4.1 \text{ tons per year}}$
other dairy cattle	=	$\frac{\text{average consumption of harvested roughages for other dairy cattle in Kansas}}{\text{average consumption of harvested roughages per U.S. dairy cow}}$
0.5756	=	$\frac{2.36 \text{ tons per year}}{4.1 \text{ tons per year}}$
grain fed cattle	=	$\frac{\text{average consumption of harvested roughages for cattle of feed in Kansas}}{\text{average consumption of harvested roughages per U.S. dairy cattle}}$
0.5487	=	$\frac{2.25 \text{ tons per year}}{4.1 \text{ tons per year}}$
other beef cattle	=	$\frac{\text{average consumption of harvested roughages for other beef cattle in Kansas}}{\text{average consumption of harvested roughages per U.S. dairy cow}}$
0.2073	=	$\frac{0.85 \text{ tons per year}}{4.1 \text{ tons per year}}$

$$\begin{aligned} \text{sheep} &= \frac{\text{average consumption of harvested} \\ &\quad \text{roughages for sheep in Kansas}}{\text{average consumption of harvested} \\ &\quad \text{roughages per U.S. dairy cow}} \\ 0.0244 &= \frac{0.10 \text{ tons per year}}{4.1 \text{ tons per year}} \end{aligned}$$

APPENDIX C

ANIMAL UNITS FOR 1967-68 FEEDING YEAR

Grain-consuming and roughage-consuming animal units are found by multiplying the number of animals in each class by its grain-consuming and roughage-consuming animal unit factor and then summing these products up. For a specific example, Table C-1 shows grain-consuming animal units for the feeding year 1967-68.

Table C-1.--Livestock numbers and grain-consuming animal units for Kansas, feeding year 1967-68.

Class of livestock	State Number	Grain-consuming Animal Unit Factor	Grain-consuming Animal Units ^a
Dairy cows, Jan. 1, 1968	240,000	0.9475	227,000
Other dairy cattle, Jan. 1, 1968	106,000	0.2204	23,000
Cattle on feed, Jan. 1, 1968	610,000	1.9968	1,218,000
Other beef cattle, Jan. 1, 1968	4,608,000	0.0770	355,000
Hogs fed, 1968 ^b	2,523,040	0.4168	1,052,000
All sheep and lambs, Jan. 1, 1968	402,000	0.0579	23,000
Hens and Pullets, Jan. 1, 1968	5,122,000	0.0369	189,000
Chickens raised, 1968	4,643,000	0.0088	41,000
Turkeys raised, 1968	395,000	0.0365	14,000
State total grain-consuming animal units			3,142,000 ^c

^aColumn 2 multiplied by column 3 and then rounded to nearest thousand.

^bGeorge Allen and Margaret Devers, National and State Livestock-Feed Relationships, (Washington D.C.: U.S. Department of Agriculture, Statistical Bulletin No. 446, 1970), pp. 87. The authors reported that from 1959 to 1968, 24 per cent of the feed fed to the spring pig crop in 1967 was fed after October 1, 1967. Hogs fed were found by adding 24 per cent of the spring pig crop in 1967, the entire fall pig crop of 1967, and 76 per cent of the spring pig crop of 1968. Thus, the hogs fed in 1968 were:

spring pig crop of 1967	1,265,000 X 0.24 =	303,600
fall pig crop of 1967	1,198,000 X 1.00 =	1,198,000
spring pig crop of 1968	1,344,000 X 0.76 =	<u>1,021,440</u>
Total hogs fed for 1967-68		
feeding year		2,523,040

^cGrain-consuming animal units totaled 3,080,000 according to Allen and Devers, pp. 32. This difference is attributable to 10,000 animal units of horses and mules, 2,000 animal units of broilers, and to 71,048 animal units from using a different procedure to calculate the animal unit factor for cattle on feed.

Roughage-consuming animal units were calculated for the same feeding year. Table C-2 indicates livestock numbers and roughage-consuming animal units for Kansas, feeding year 1967-68.

Table C-2.--Livestock numbers and roughage-consuming animal units for Kansas, feeding year 1967-68.

Class of Livestock	State Number	Roughage-consuming Animal Unit Factor	Roughage-consuming Animal Units ^a
Dairy cows, Jan. 1, 1968	240,000	1.0000	240,000
Other dairy cattle, Jan. 1, 1968	106,000	0.5756	61,000
Cattle on feed, Jan. 1, 1968	610,000	0.5487	335,000
Other beef cattle, Jan. 1, 1968	4,608,000	0.2073	955,000
All sheep & lambs, Jan. 1, 1968	402,000	0.0244	<u>10,000</u>
State total of roughage consuming animal units			1,601,000

^aColumn 2 multiplied by column 3 and then rounded to nearest thousand.

APPENDIX D

LIVESTOCK ESTIMATES FOR COUNTIES

Numbers of some classes used in animal unit calculations were not available at the county level. Therefore, the following procedures were used to estimate numbers for these classes in each feeding year for each county.

CATTLE ON FEED

Cattle on feed on farms for a feeding year was found as follows:

$$\begin{array}{llll} \text{Cattle on feed} & & & \text{Cattle on feed} \\ \text{Jan. 1 for a} & & & \text{Jan. 1 for Kansas} \\ \text{county} & = & \text{County marketings of} & \text{Grain fed cattle} \\ & & \text{grain fed cattle} & \text{marketings during} \\ & & \text{during the year} & \text{the year for Kansas} \end{array} \quad \times$$

At the time this study was made grain fed cattle marketed for 1971 was not available at the county level, however, grain fed cattle marketed for Kansas was available.

OTHER DAIRY CATTLE

Other dairy cattle on farms Jan. 1 of a feeding year was found as follows:

$$\begin{array}{llll} \text{Other dairy cattle} & & & \text{Other dairy cattle} \\ \text{on farms in a county} & = & \text{Number of dairy cows} & \text{Jan. 1 for Kansas} \\ \text{Jan. 1} & & \text{on farms Jan. 1 for a} & \text{Kansas dairy cows} \\ & & \text{county} & \text{on farms Jan. 1} \end{array} \quad \times$$

OTHER BEEF CATTLE

Other beef cattle is the number of other cattle less other dairy cattle and cattle on feed.¹ This was found by:

Other beef cattle Jan. 1 for a county	=	Other cattle in a county Jan. 1	-	Other dairy cattle on farms in a county Jan. 1	-	Cattle on feed Jan. 1 for a county
---	---	---------------------------------------	---	---	---	--

HOGS FED

Hogs fed in a county are found as follows:²

Hogs fed in a county for a feeding year	=	Hogs on farms Jan. 1 for a county	X	Hogs fed in Kansas during the feeding year Hogs on farms Jan. 1 for Kansas
---	---	---	---	---

HENS AND PULLETS

Hens and pullets on farms in a county was found by:

Hens and pullets in a county Jan. 1	=	Chickens in a county Jan. 1	X	Hens and pullets on farms Jan. 1 for Kansas State number of all chickens on farms Jan. 1
--	---	--------------------------------	---	---

CHICKENS RAISED

Chickens raised was found by:

Chickens raised in a county during the year	=	Chickens on farms Jan. 1 in a county	X	Chickens raised in Kansas during the year All chickens on farms in Kansas, Jan. 1
---	---	---	---	---

¹Other cattle is the sum of other dairy cattle, other beef cattle, and cattle on feed. Other dairy cattle and other beef cattle are defined on pg. 7.

²Appendix C

APPENDIX E

GRAIN FED CATTLE PRODUCTION, AS LIMITED BY HARVESTED ROUGHAGES, 1966-71

Table	Title	Page
E-1	Potential additional grain fed cattle production, based on surplus (or deficit) harvested roughage availability by county, crop reporting district, and Kansas, feeding years 1966-71 and 5-year average	69

Table E-1--Potential additional grain fed cattle production, based on surplus (or deficit) harvested roughage availability by county, crop reporting district, and Kansas, feeding years 1966-71 and 5-year average.^a

County, crop reporting district, and state	Feeding Year					5 year average
	1966-67	1967-68	1968-69	1969-70	1970-71	
	(number of head)					
Northwest:						
Cheyenne	-305	21,187	-835	4,820	-3,255	4,322
Decatur	5,117	4,368	2,133	4,443	-2,093	2,914
Graham	9,350	8,330	10,193	6,362	7,405	8,332
Norton	11,195	9,090	7,643	9,268	3,144	8,050
Rawlins	12,456	1,279	-1,653	3,098	2	3,036
Sheridan	-2,930	1,304	4,913	-6,032	-848	-729
Sherman	10,399	10,422	14,402	9,212	1,180	9,123
Thomas	4,675	-3,357	6,306	-3,016	-3,513	222
District Total	49,566	53,233	43,192	28,123	2,024	35,269
West Central:						
Gove	-21,511	-24,528	-7,426	-9,162	-27,161	-17,958
Greeley	-3,330	-704	-2,413	4,303	5,401	591
Lane	-7,933	-4,940	-8,380	-6,285	-14,321	-8,372
Logan	-1,700	2,720	1,016	3,827	-2,728	627
Ness	-1,703	-3,156	2,689	6,099	-6,911	-593
Scott	-4,231	-2,925	-8,615	-22,364	-17,433	-11,114
Trego	3,862	856	1,277	3,599	-2,916	1,336
Wallace	6,257	3,977	3,354	8,017	5,821	5,485
Wichita	6,917	-1,869	-14,023	-8,644	-23,977	-8,319
District Total	-23,372	-30,568	-32,532	-20,910	-84,227	-35,322
Southwest:						
Clark	-12,729	-14,108	-14,972	-14,073	-13,683	-13,913
Finney	-5,242	-10,295	20,237	16,947	-1,171	4,095
Ford	-32,678	-32,196	-44,807	-46,128	-52,343	-41,751
Grant	-176	-2,291	-4,472	-17,647	-20,818	-9,081
Gray	-10,125	-7,389	4,036	4,848	-29,882	-7,732
Hamilton	7,574	21,785	8,697	14,373	5,537	11,594
Haskell	-9,669	-210	-17,977	-7,747	-14,697	-10,060
Hodgeman	-8,211	-3,607	-9,913	-1,813	-7,179	-6,161
Kearny	5,621	7,128	7,183	-12,332	2,617	2,044
Neade	-6,661	-4,812	-13,938	-6,630	-6,641	-7,737
Norton	3,200	283	4,757	2,082	-697	1,925
Seward	1,572	6,539	-1,104	-27,140	-27,516	-9,530
Stanton	-4,062	-4,672	42	-16,576	-16,700	-8,394
Stevens	-595	4,904	252	-543	43	812
District Total	-72,130	-36,942	-62,060	-112,578	-183,735	-93,859
North Central:						
Clay	4,538	17,088	5,356	3,617	6,238	7,378
Cloud	11,730	19,246	16,683	16,596	8,466	14,540
Jewell	10,482	32,333	19,410	22,213	-845	16,720
Mitchell	7,698	10,735	-3,717	9,440	-5,130	3,787
Osborne	3,880	11,287	8,545	19,244	-3,316	7,928
Ottawa	14,036	26,335	13,318	18,279	4,468	15,267
Phillips	7,007	7,896	16,041	15,144	4,654	10,149
Republic	6,723	2,354	1,517	3,116	-4,106	1,922
Rooks	2,789	5,277	12,431	11,130	547	6,435
Smith	663	4,795	1,126	16,790	82	4,691
Washington	-491	21,792	4,835	3,951	-18,901	2,219
District Total	69,021	159,053	95,545	139,521	-7,864	91,055
Central:						
Barton	15,216	-2,872	-10,012	-17,364	-37,946	-10,596
Dickinson	6,646	38,941	19,479	17,893	6,209	17,652
Ellis	4,445	5,101	-12,652	4,838	-10,382	-1,830
Ellsworth	10,347	6,087	1,670	14,888	1,949	6,988
Lincoln	6,477	22,783	8,647	14,969	1,807	10,937
McPherson	3,578	21,341	8,120	10,611	-2,879	8,152
Marion	7,561	22,168	22,027	9,905	6,393	13,593
Rice	5,370	9,613	-3,826	10,938	537	4,527
Rush	1,211	5,377	-876	4,064	-3,397	1,276
Russell	5,859	12,317	2,972	12,125	-2,435	6,168
Saline	9,266	19,947	3,527	13,981	5,280	10,352
District Total	76,566	159,904	33,127	95,949	-33,453	67,218

Table E-1-Continued

South Central						
Barber	-3,852	-4,496	-6,079	4,859	-17,383	-5,393
Comanche	-6,912	-2,889	-4,780	-1,467	-8,044	-4,818
Edwards	8,842	10,056	8,516	2,535	-267	5,937
Harper	-3,979	2,202	-4,354	7,203	-6,875	-1,101
Harvey	-831	13,521	-1,537	4,530	4,165	3,970
Kingman	10,986	4,235	6,312	5,537	3,142	6,042
Kiowa	-19	703	-3,907	-1,468	-3,896	-1,718
Lawnee	2,213	5,740	7,889	5,066	4,377	5,057
Pratt	-8,779	-11,272	-20,388	-24,863	-35,941	-29,248
Reno	24,031	25,713	11,738	27,585	11,743	23,162
Sedgwick	10,681	23,884	14,687	15,596	7,443	14,458
Stafford	14,800	12,537	5,761	16,109	8,909	11,623
Sumner	6,385	24,088	14,018	17,250	-1,961	11,956
District Total	53,568	104,021	28,176	78,474	-34,588	45,930
Northeast:						
Atchison	2,298	3,798	8,244	9,464	1,980	5,157
Brown	-13,396	-11,312	-7,497	-5,575	-19,512	-9,618
Doniphan	-5,491	1,305	-2,218	3,144	-2,524	-1,257
Jackson	18,539	22,161	19,771	18,606	6,588	17,133
Jefferson	14,984	9,263	19,442	6,280	2,745	13,543
Leavenworth	10,384	9,969	19,369	15,737	7,135	12,525
Marshall	10,013	23,165	20,605	18,824	1,684	14,858
Meraha	911	-5,405	-9,812	-1,664	-21,823	-7,559
Pottawatomie	9,536	22,242	29,592	26,769	11,972	29,022
Riley	12,220	13,964	11,796	7,408	3,392	9,756
Wyandotte	3,554	7,932	2,375	390	-713	2,738
District Total	63,053	97,004	111,664	99,445	92	75,267
East Central:						
Anderson	836	12,485	7,381	15,622	11,496	9,564
Chase	-28,371	-17,346	-31,436	-26,129	-31,631	-27,023
Coffey	9,130	13,432	13,323	20,084	-221	11,149
Douglas	13,778	16,666	14,039	11,214	5,219	5,748
Franklin	3,512	5,612	20,324	3,546	-4,753	5,318
Geary	2,322	13,115	5,524	4,921	700	5,318
Johnson	10,799	9,924	16,214	9,466	2,021	2,681
Linn	4,302	15,494	7,628	14,454	-838	8,298
Lyon	-11,648	3,315	-11,178	-6,265	-15,323	-6,220
Miami	14,606	17,904	13,123	20,509	-5,128	12,214
Morris	200	20,462	10,457	11,431	5,179	9,546
Ossage	13,262	24,566	23,676	13,018	1,756	15,256
Shawnee	15,677	18,095	12,816	10,689	1,709	11,797
Wabaunsee	19,253	29,862	17,308	11,172	3,464	12,616
District Total	58,649	174,736	119,755	113,731	-26,530	60,078
Southeast:						
Allen	3,134	16,986	8,523	14,735	5,481	7,772
Bourbon	18,743	16,002	12,621	13,300	2,784	12,850
Butler	-15,030	8,755	1,776	-3,307	-33,846	-8,510
Chautauqua	-8,036	-2,686	-1,925	-3,920	-8,369	-4,965
Cherokee	3,139	2,557	795	1,880	-4,172	840
Cowley	-6,950	6,278	-3,013	-17,665	-27,375	-9,731
Crawford	2,963	4,569	365	3,466	-1,222	2,032
Elk	-7,305	6,553	1,452	-1,418	-7,535	-1,645
Greenwood	-1,408	9,627	7,281	-5,659	-13,990	-830
Labette	-9,081	-9,862	-16,543	-22,651	-20,664	-16,320
Montgomery	7,098	10,009	3,439	1,673	-2,514	3,937
Neosho	1,714	4,329	4,468	413	-3,764	1,430
Wilson	3,038	21,989	19,862	5,536	1,672	8,653
Woodson	6,710	13,046	19,717	1,444	-10,565	2,620
District Total	-2,212	107,725	69,619	-12,354	-132,000	7,438
State Total	272,958	788,292	321,584	409,599	-502,361	277,414

* Assumes entire surplus or deficit was fed only to beef cattle.

LIVESTOCK-FEED BALANCES IN KANSAS DURING 1966-71

by

MICHAEL W. DOXTADER

B.S., Kansas State University, 1971

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Economics

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1973

ABSTRACT

The competitive position and potential for further expansion of the Kansas livestock industry is directly related to availability of feed grains and roughages. This study was directed toward a determination of current feed grain and roughage balances by county, crop reporting district and the state as a whole. Feed balance is defined as the difference between production and utilization. For any given area the balance can be positive or negative. A negative balance indicates that feed must be imported to that area to satisfy requirements. A positive balance (or surplus) indicates that further livestock expansion can take place and gives a measure of the possible extent of expansion. Studies of the economic feasibility of additional feedlots in a given area, for example, rely heavily on the availability of surplus feed in that and adjoining areas.

During the period 1966-70 feed grain balances for the state on a whole increased consistently year by year from 2.3 million tons to 3.4 million tons. In the 1970-71 feeding year the balance dropped to 1.8 million tons - a reflection of unfavorable weather and plant disease. The surplus of feed grains in 1970 would have supported an additional 1.5 million fed cattle or 3.7 million additional hogs, or any combination of the two species in a ratio of about one head of cattle to 2.5 head of hogs.

On a district basis, southwest Kansas had the largest surplus followed by the Northeast district. Central, South Central, and Southeast Kansas were near equilibrium in feed grain production and use.

Counties with consistent large surpluses were: Wichita, Grant, Haskell, Marion, Stanton and Stevens. Substantial deficits occurred in Barton, Chase, Gove, and Ford. An increasing trend in feed grain surpluses was evident in Western counties, coincident with irrigation development.

On balance, Kansas is close to equilibrium in production and utilization of roughages. It appears that production is rather closely geared to requirements. This is expected from an economic standpoint. Roughages have a relatively low value compared to their bulk and with the possible exception of hay are not feasible cash crops for markets beyond the local area.