Minimum Farm Sizes for Given Income Levels in Two Kentucky Bluegrass Areas

by

Charles M. Cuskaden and James F. Thompson

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MINIMUM FARM SIZES FOR GIVEN INCOME LEVELS IN
TWO KENTUCKY BLUEGRASS AREAS

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Charles M. Cuskaden and James F. Thompson*

INTRODUCTION

Many Kentucky farms do not contain enough land to enable their operators to earn a level of income comparable to that which they could earn on larger farms or in alternative employment. The desire for increased incomes can, in the long run, be expected to cause many of the operators of small farms to either move to larger farms or to seek nonfarm employment paying them more than their labor is earning in farming. A movement of these farmers out of agriculture presumably would leave such small farms available for combination into larger farms. If the markets for farm inputs operate properly, these adjustments will continue until most full-time farms are large enough so that their operators are able to earn labor incomes comparable to those which they could earn in nonfarm employment. Thus, the size (acreage) of full-time farms can be expected to approach some minimum. This minimum will be approximately the least amount of land which would permit an operator and his family to earn a labor income about equal to what they could earn in nonfarm employment.

Information concerning the amount of land necessary for a farmer to earn a given level of return to his labor and management provides a basis for economic evaluation of individual farming situations. It also provides a useful guide to persons faced with choosing between farming and other possible uses for their labor and management. Such estimates, made for different areas, help to locate regions in which adjustments in farm numbers could be expected in the future. They also provide a basis for estimating the size of the adjustment needed to bring about a balance between the farm and nonfarm sectors of the economy with regard to the use of labor.

Objectives of Study

In order to provide the above information, this study was directed toward two specific objectives. First, it was desired to estimate for different areas of Kentucky the minimum amount of land which would yield a given level of income when combined with appropriate amounts of other inputs. The second objective was to combine the minimum farm size results with the present farm size distributions for the different areas and obtain estimates of the numbers of farms which would have to be combined with others in order to bring all farms to at least the minimum size.

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Study Areas

This study was made in two areas of the Kentucky, Bluegrass region. These are the Inner and Outer Bluegrass areas. They are shown in Figure 1. There are substantial differences between these areas in topography, soil types, farm sizes and type of farming [3].

The Inner Bluegrass is the more productive. It is a gently rolling fertile upland of about 1,700 square miles. Practically the entire area can be used for harvested crops or pasture. About 41 percent of it is suited to row crop production [2]. Tobacco, beef and sheep are the dominant farm enterprises.

The Outer Bluegrass is similar except that the land is more rolling and not as productive. About 80 percent of the area can be used for harvested crops and pasture with about 30 percent suited to row crop production [2]. Tobacco, dairying and beef production are the main farm enterprises.

Assumptions

The soil type, topography and climate characterizing an area are fixed elements of the environment within which the area's farm economy operates; thus, it would not be realistic to make assumptions which differ from reality in these respects. In some other respects, though, no attempt was made to approximate current conditions.

The income level selected was a return of $5,000 to the farm family's labor and management. This is much higher than the incomes currently being earned by most of the farm families in the Bluegrass region. It is substantially higher than the 1965 family labor and management returns of $2,263 and $3,611 on typical, commercial family-operated, tobacco-livestock farms in the Inner and Outer Bluegrass respectively [1]. For the reasons set forth on earlier pages of this report, it seems reasonable to project farm incomes significantly higher than at present.

A high level of managerial ability and an advanced level of technology were assumed. This means that the farm operator is assumed to be capable of learning about improved practices and applying them to his situation effectively. It also means that he is capable of combining the enterprises on his farm so as to minimize conflicts between them and produce an overall organization which operates smoothly. This also seems a reasonable projection in view of the rate of advance in technology and the increasing level of education of Kentucky farmers.

Tobacco was priced at 58.8 cents per pound in all situations studied. Tobacco acreage allotments were set at 3.2 percent of the farm land in the Inner Bluegrass and 2.4 percent in the Outer Bluegrass [1]. Prices assumed for the main input items bought and sold by farmers are included in Appendix Tables 1 and 2.

The farm operator was assumed to spend full time on the farm. The supply of unpaid family labor was assumed to be sufficient to accomplish all the tasks which require two or more persons working simultaneously. The alternative of hiring additional labor was not considered. It was also assumed that capital would be available in unlimited amounts at an interest rate of 5.0 percent for investments in real estate and 6.0 percent for other capital.

PROCEDURES

The procedures following in this study, after delineation of the two subareas, concerned (1) the estimation of the farming programs which would require the minimum amounts of land and (2) the determination of the size of the adjustment which would be

needed to bring all farms in the area at at least the minimum size.

The minimum land program... estimated by means of linear programming. The data required were also available... by-product of a regional research project concerning profitable adjustments... of farm resources in the southern... States.[2]

In order to determine the... needed adjustment in farm... first necessary to determine... distribution of farms by size... area, the U.S. Census of... suitable for this use... the areas do... approximately, ... counties in the area... reported by counties... needed were obtained from... of the U.S. Agricultural Stabilization and Conservation Service. These...

FARM SIZE DISTRIBUTIONS

Farm size distributions for the two... Bluegrass Areas were not greatly different from each other in 1969. Table 1 shows that the Inner Bluegrass has more of its farms in the 10-49 acre range. This could be partially due to the fact that relatively more of the Inner Bluegrass farms are situated near urban centers, and the opportunities for part-time farming are better. Part-time farms tend to be smaller than full-time farms. The difference could also be partially due to the fact that Inner Bluegrass farms have relatively more tobacco allotments than do those in the Outer...

[1] Linear programming is a method of selecting from a number of possible enterprises that combination which would yield the maximum largest from the available resources.

[2] This was Regional Project S-42 titled "An Appraisal of Farming Adjustment Opportunities in the Southeast to Meet Changing Conditions."
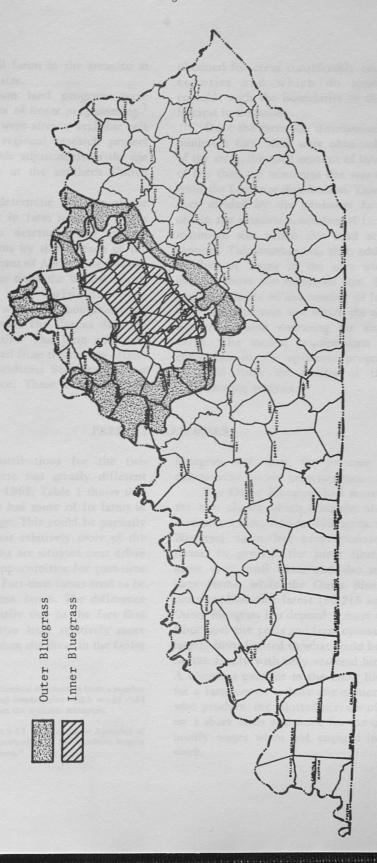
Outer Bluegrass

Inner Bluegrass

Figure 1.--The Area of Study, Bluegrass Region, Kentucky

needed to bring all farms in the areas to at least the minimum size.

The minimum land programs were estimated by means of linear programming.[1] The data required were already available as a by-product of a regional research project concerning profitable adjustments in the use of farm resources in the southern United States.[2]

In order to determine the size of the needed adjustment in farm numbers, it was first necessary to determine the current distribution of farms by size in each of the areas. The U. S. Census of Agriculture was not suitable for this use since the boundaries of the areas do not coincide, even approximately, with the boundaries of counties in the areas. The Census data are reported by counties. The farm size data needed were obtained from the county offices of the U. S. Agricultural Stabilization and Conservation Service. These data could be

obtained for areas considerably smaller than counties and which do approximately coincide with the boundaries of the areas of interest in this study.

Once the farm size distributions and the minimum farm sizes were obtained for each of the areas, the total amount of land in farms of less than the minimum size was computed from the farm size distribution. This total was then divided by the minimum farm size to obtain the maximum number of farms of the minimum size which this land area would support. This number was then added to the number of farms in the area which were already above the minimum size. The result was an estimate of the number of farms of at least the minimum size which the area could support without deceasing the size of any farm. The capital requirements and the enterprises in the optimum programs were obtained from the results of the linear programming analysis.

PRESENT FARM SIZES

Farm size distributions for the two Bluegrass Areas were not greatly different from each other in 1962. Table 1 shows that the Inner Bluegrass has more of its farms in the 10-49 acre range. This could be partially due to the fact that relatively more of the Inner Bluegrass farms are situated near urban centers, and the opportunities for part-time farming are better. Part-time farms tend to be smaller than full-time farms. The difference could also be partially due to the fact that Inner Bluegrass farms have relatively more tobacco allotment than do these in the Outer

Bluegrass and, thus, the pressure for farm enlargement has not been so great.

The Outer Bluegrass had more farms in the two classes which comprise the 70-139 acre size range. Above 260 acres, the Inner Bluegrass again has proportionately more farms. In general, the Inner Bluegrass has more very small farms and also more very large farms, while the Outer Bluegrass has more medium-size farms (50-219 acres). The Outer Bluegrass has depended more on family labor over the years and farm operations have largely been limited to what could be handled by the family with only seasonal hired labor. A common practice in the Inner Bluegrass is for a farm owner to have one or more tenants who produce the allotted acreage of tobacco on a share basis and work for the owner for hourly wages when not engaged in tobacco work.

[1]Linear programming is a method of selecting from a number of possible enterprises that combination which would yield the maximum income from the available resources.

[2]This was Regional Project S-42, "An Economic Appraisal of Farming Adjustment Opportunities in the Southern Region to Meet Changing Conditions."

Table 1.—Farms by Size—Inner and Outer Bluegrass Areas, 1962

Size intervals (Acres)	Inner Bluegrass		Outer Bluegrass	
	Number	Percent	Number	Percent
10-49	1,526	26.65	2,525	21.67
50-69	533	9.30	1,143	9.82
70-99	669	11.67	1,725	14.82
100-139	790	13.79	1,971	16.92
140-179	541	9.44	1,262	10.84
180-219	376	6.57	924	7.93
220-259	291	5.07	586	5.04
260-499	684	11.94	1,149	9.86
500 and over	319	5.57	361	3.10
Total	5,729	100.00	11,646	100.00
Average size of farm, acres	169.8		146.1	

MINIMUM FARM SIZES FOR $5,000 LABOR AND MANAGEMENT RETURN

The amount of any input necessary to produce a given level of income depends on (1) the productivity of that input and (2) the availability of enterprises which use that input intensively (that is, enterprises which produce a relatively high income per unit of that input). In the case of land, the Inner Bluegrass is the more productive of the two areas. The enterprises found in each of the areas range from very intensive land users (tobacco) to very extensive land users (pasture). Tobacco production, however, is limited by the acreage allotments established under the federal production control program. The Inner Bluegrass has larger tobacco allotments relative to farm sizes than the Outer Bluegrass. Thus, both of the above factors would indicate that minimum farm sizes would be smaller in the Inner Bluegrass. Table 2 shows that this was the case. The minimum farm size of 79 acres for the Inner Bluegrass is substantially less than that required in the Outer Bluegrass. The land in the Outer Bluegrass is almost as productive as that in the Inner Bluegrass but tobacco allotments are considerably smaller.

In terms of the ability of the land to support farm population, the Inner Bluegrass is superior to the Outer. However, the improvement of technology over the years has raised the possible output per acre of land to such levels that land area may no longer be a critical factor. Increasing capital requirements in agriculture may cause capital availability to be fully as important as the supply of land if not more so. The data in Table 2 indicate that while less land is required in the Inner Bluegrass to produce a given income, considerably more capital is required. The explanation for this fact is also found in Table 2. The nonland capital required to produce a labor and management return of $5,000 is

Table 2.—Estimated Land Acreage, Gross Income and Capital Necessary to Yield $5,000 Return to Labor and Management, Two Kentucky Bluegrass Areas

	Inner Bluegrass	Outer Bluegrass
Minimum farm size, acres	$ 79.00	$ 97.00
Gross income	12,387.00	11,128.00
Income from tobacco	3,220.00	2,890.00
Investment in land, dollars	31,600.00	22,019.00
Nonland capital required	16,390.00	13,777.00
Land investment per acre	400.00	227.00
Gross income per acre	156.80	114.72

roughly the same in both areas. The required investment in land, however, differs greatly among the areas. Although more land is required to produce the $5,000 income in the Outer Bluegrass, the required total investment in land is considerably less than in the Inner Bluegrass. Looking at the same facts in another way, Inner Bluegrass land produces about 37 percent more income per acre than does Outer Bluegrass land but is priced about 76 percent higher. Thus, (in 1967) a dollar invested in land in the Inner Bluegrass

produced only about 78 percent as much gross income as the same dollar invested in land in the Outer Bluegrass.

Another interesting fact evident from Table 2 is that the gross income required for a $5,000 labor and management return is about the same in both areas. A dollar of gross income yields 40 cents in labor and management returns in the Inner Bluegrass as against 45 cents in the Outer Bluegrass.[3] In addition, the gross income from tobacco was slightly more than one fourth of total gross income in each case.

ENTERPRISES IN MINIMUM LAND PROGRAMS

A farm program which yields a given income with a minimum acreage of land is also a program which produces more income per acre of land than any other. If there were no restrictions on the level of any enterprise, a minimum land program would include only one enterprise and it would be the one which would produce more income per acre than any other. This, in the Bluegrass region, would be tobacco. However, acreage allotments impose an upper limit on the tobacco enterprise.

If the tobacco allotment did not do this, the labor supply would probably be exhausted before enough tobacco could be produced to yield the required income. Thus, labor imposes an indirect upper limit on the tobacco enterprise. The above would indicate that, in each area, minimum land programs

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[3]These amounts seem high in relation to those actually found on Bluegrass farms. This is due to the fact that the level of technology used in this study is substantially higher than that actually in use on most farms in the Bluegrass.

would include as much tobacco as the acreage allotment would permit if sufficient labor were available. In neither of the areas would a tobacco enterprise of this size satisfy the income requirement, other enterprises must be included to supplement tobacco.

The best combination of these supplementary enterprises will depend largely on the amounts of labor available in addition to those needed for tobacco. If these amounts are small, supplementary enterprises must be *labor intensive.* If considerable labor is available for them, the supplementary enterprises will be *land intensive*, i.e., they will be those enterprises which produce a relatively high income per unit of land. The fact that the assumed labor supplies were the same in both areas (even though the Inner Bluegrass had the largest tobacco allotments relative to farm size) would indicate that the supplementary enterprises in that area would tend to be more labor intensive than those in the Outer Bluegrass. Table 3 shows that this was the case. In the Inner Bluegrass, two systems of beef feeding were included in the optimum program. In addition to the deferred feeding plan, which was the only one in the programs for the Outer Bluegrass, the Inner Bluegrass minimum land program included a system based on winter feeding for 180 days.

The winter feeding system produces less income per hour of operator labor but more income per acre of land than the deferred feeding plan (Table 4).

The winter feeding system of beef production produces less labor and management return per bushel of corn than does the deferred feeding system. The minimum-land programs for the Inner Bluegrass contain a slightly higher proportion of the land in corn and a slightly smaller proportion in pasture than do those for the Outer Bluegrass. Had the livestock program for the Inner Bluegrass consisted entirely of deferred fed steers, the pasture supply would have been exhausted before the grain produced had been profitably used. Thus, it was necessary to handle some of the steers on the winter feeding system in order to economize on pasture and use the available grain.

The cropping programs in both areas reflect mainly the size of the tobacco allotments, the topography and the feed needs of the livestock enterprises used. The entire tobacco allotment was used in each area. The cropping system in the Inner Bluegrass relied more heavily on corn and alfalfa hay having about one fourth of the total land in each.

ADJUSTMENTS TO MINIMUM FARM SIZES

The size of the adjustment necessary to bring all farms in an area to at least the minimum size depends partially on the proportion of the area's farms which are smaller than the minimum size.[4] Table 5 shows that the areas are not much different in

this respect. The adjustment would be smaller in the Inner Bluegrass where about 40 percent of the farms are below the 79 acres necessary to earn the $5,000 labor and management return. The Outer Bluegrass has about 45 percent of its farms below the 97-acre minimum size.

In the adjustment process, the 2,241 Inner Bluegrass farms of less than minimum size would need to be replaced by 1,058 farms of the minimum size. The farms which would be combined average 38 acres in size. In the Outer Bluegrass, 5,228 farms averaging

[4]The analysis in this section ignores the problems involved in combining small farms where large and small farms are interspersed in a more or less random pattern. In many cases it would be difficult if not impossible to effect such combinations. Consequently the estimates in this section are the absolute maximum numbers of farms which the areas could support if all farms were at least the minimum size.

Table 3.—Enterprise Combinations Yielding Minimum Land Requirements,
Two Kentucky Bluegrass Areas

Enterprises	Inner Bluegrass	Outer Bluegrass
Crops (acres)		
Tobacco	2.52	2.32
Corn	26.7	22.0
Barley	0.0	0.0
Alfalfa	20.8	20.9
Sudan Grass	3.14	3.7
Pasture	25.60	27.5
Livestock (head)		
Steers: fed 180 days	16.	0.
deferred fed	51.	55.

Table 4.—Income per Acre and per Hour of Operator Labor, Selected
Livestock Enterprises, Bluegrass Region of Kentucky

Enterprise	Production requirements		Return to operator's labor & management	
	Labor (hours)	Land (acres)	Per hour of operator's labor	Per acre of land
			(dollars)	
Beef feeding:				
steer fed 180 days	10.0	0.57	2.04	35.84
steer deferred fed	9.0	1.38	4.35	28.38
Grade A (dairy cow)	92.0	3.77	1.63	39.77

**Table 5.—Adjustments in Farm Numbers Necessary for All Farms to Earn at
Least $5,000 Return to Labor and Management, Two Kentucky
Bluegrass Areas**

Area	Present number of farms (1962)	Farms to be adjusted	Farms possible on adjustable land[a]	Total farms after adjustment	Percentage reduction in farm numbers
Inner Bluegrass					
Number of Farms	5,729	2,241	1,058	4,546	20.6
Farmland (acres)	972,578	83,607	83,582	972,553	--
Outer Bluegrass					
Number of farms	11,646	5,228	2,730	9,148	21.4
Farmland (acres)	1,701,625	264,841	264,810	1,701,594	--

[a]Adjustable land is that land now in farms of less than the minimum size.

51 acres in size would need to be combined to form 2,730 farms of the minimum size. This adjustment would cause a reduction in farm numbers of 20.6 and 21.4 percent respectively in the Inner and Outer Bluegrass areas.

The proportion of the areas' total land involved in the adjustment would be considerably smaller than that for total farms. In the Inner Bluegrass, only 8.6 percent of the land would be involved as contrasted to 15.6 percent for the Outer Bluegrass. The total land in the areas would, of course, not

change.

After the adjustment, the Outer Bluegrass would contain about twice as many farms as the Inner Bluegrass which is about the same proportion as at present. Thus, the relative size of the adjustment would be about the same in both areas.

The farms which are already larger than the minimum, average 255 acres in size in the Inner Bluegrass and 224 acres in the Outer Bluegrass. This is well above the minimum in both areas.

SUMMARY AND CONCLUSIONS

Farm resources and production opportunities in two subareas of the Kentucky Bluegrass region were examined with a view to determining (1) the amounts of land necessary to yield $5,000 returns to labor and management when combined with appropriate amounts of other inputs and (2) the size of the adjustment in farm numbers which would be necessary to bring all farms in

the subareas to at least the minimum size.

The minimum farm size in the Inner Bluegrass is substantially lower than in the Outer Bluegrass. In the Outer Bluegrass the land presents more management problems, especially in erosion control, and is not capable of being used as intensively as that in the Inner Bluegrass. Minimum acreages for two-man farms are 79 acres and 97 acres,

respectively, in the Inner and Outer Bluegrass areas. In contrast, the necessary investment in land in the Outer Bluegrass is less than in the Inner Bluegrass, due to the fact that land values in the Outer Bluegrass are lower than in the Inner Bluegrass. Nonland capital requirements are approximately the same in both areas.

Adjustment necessary to bring all farms to at least the minimum acreage with two men would be about the same in both areas. The number of farms would be reduced by 20.6 percent in the Inner Bluegrass and 21.4 percent in the Outer Bluegrass.

The presence of substantial numbers of part-time farms in each of the areas might tend to reduce the pressure for farm enlargement. Such farms can be subsidized by income from off-farm jobs should the farm family be willing to do this in order to be able to live in the country. However, it has been shown that, in some areas, part-time farms are not as efficient as full-time farms. Should future technological improvements tend to be those which require large capital outlays with accompanying high fixed cost, this will tend to increase the pressure for farm enlargement to increase production and reduce the fixed cost per unit of output. This, in turn, will put further pressure on farm product prices. Part-time farms, in the main, are rather small and less able to adopt such technological improvements than are full-time farms. Yet, they must sell their products on the same markets with those farmers who are able to use such improvements and at the depressed prices brought about by the new technology. The costs of inefficiency, which must be borne by part-time farm families, would become higher and higher. The role which part-time farms will play in these adjustments must remain in doubt until more is known concerning probable future technological developments and their effects on costs and the willingness of part-time farm families to bear the costs of inefficiency. The actions of part-time farmers, however, will probably determine, to a large extent, the nature of the land market in coming years.

Another factor which will play an important role in facilitating or hindering adjustments is the degree of availability of appropriate financing for land transfers or of tenure arrangements which will distribute the financial rewards of production among the productive agents in a manner such as will encourage the optimum use of farm resources.

REFERENCES

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[2] Kentucky Conservation Needs Committee, *Kentucky Soil and Water Conservation Needs Inventory*, Agricultural Experiment Station, Lexington, 1962.

[3] Karraker, P. E. *Soils of Kentucky*, Kentucky Agricultural Experiment Station Circular 67, 1955.

[4] Thompson, James F. *Part-time Farming and Resource Productivity in Western Kentucky.* Bulletin 688, University of Kentucky Agricultural Experiment Station, Lexington, 1964.

APPENDIX

Table 1.—Assumed Prices Received by Farmers,
Bluegrass Region, Kentucky

Product	Unit	Price
Crops		
Burley Tobacco[a]	cwt.	$ 58.80
Wheat	bu.	1.25
Livestock and Livestock Products:		
Cull Dairy Cows	cwt.	15.00
Dairy Calves	head	5.00
Surplus Dairy Heifers	head	125.00
Grade A Milk	cwt.	4.75
Grade C Milk	cwt.	3.30
Blend Price for Milk[b]	cwt.	4.25
Market Hogs	cwt.	15.00
Feeder Pigs (40 lbs.)	head	11.00
Boars	head	125.00
Cull Sows	cwt.	11.50
Lambs	cwt.	20.00
Wool	lb.	.51
Cull Ewes	head	6.00
Rams	head	45.00
Feeder Calves (500 lbs.)	cwt.	20.37
Feeder Steers (775 lbs.)	cwt.	19.40
Feeder Cattle (850 lbs.)	cwt.	18.43
Choice Steers (950-1,000 lbs.)	cwt.	21.63
Prime Steers (1,050 lbs.)	cwt.	22.88
Cull Beef Cows	cwt.	15.00
Bulls (Beef)	head	400.00

[a]This is the base price assumed in this study. In addition, 120 and 140 percent of the base price were used.

[b]Based on 54 percent Class I utilization. .65($4.75) + .35($3.30) = $4.25.

APPENDIX—*Continued*

Table 2.—Assumed Prices Paid by Farmers, Bluegrass Region, Kentucky

Item	Unit	Price
Seed:		
Alfalfa	lb.	$ .45
Red Clover	lb.	.45
Ladino Clover	lb.	.65
Korean Lespedeza	lb.	.14
Bluegrass	lb.	.80
Orchard Grass	lb.	.32
Sudan Grass	lb.	.13
Barley, Certified	bu.	2.50
Corn, Certified	bu.	10.00
Rye	bu.	2.25
Feed:		
Wheat Bran	cwt.	3.50
16% Dairy Feed	cwt.	3.75
Cottonseed Meal	cwt.	4.70
Pig Starter	cwt.	5.20
Fertilizer:		
Nitrogen	lb.	.11
K_2O	lb.	.043
P_2O_5	lb.	.0675
Limestone, Spread	ton	2.75
Livestock:		
Boars	head	125.00
Bulls (Beef)	head	400.00
Rams	head	75.00
Ewes	head	23.00
Feeder Steers (375 lbs.)	cwt.	23.26
Feeder Steers (450 lbs.)	cwt.	20.90
Feeder Steers (500 lbs.)	cwt.	20.37
Feeder Steers (550 lbs.)	cwt.	19.88
Feeder Steers (600 lbs.)	cwt.	19.40
Feeder Steers (800 lbs.)	cwt.	18.81