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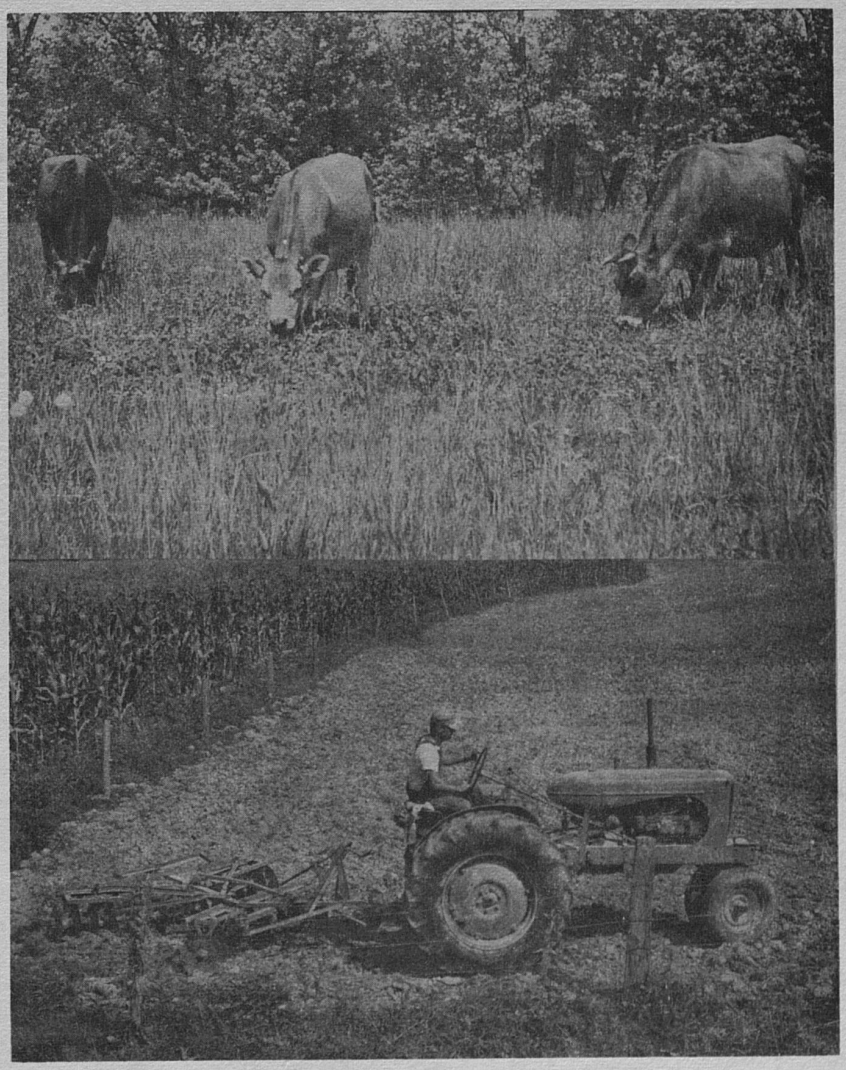
SOURCES OF INCOME ON TRIGG, CALLOWAY AND GRAVES COUNTY BOTTOMLAND FARMS, 1951



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Introduction

As part of a study designed to determine the earning power of investments and inputs on western Kentucky farms, bottomland farm businesses located in Trigg, Calloway, and Graves county were studied. Records were secured from 32 farms located in the Cumberland River bottom of Trigg county, from 29 farms located in the Clarks River bottom of Calloway county, and from 28 farms located mainly in the Mayfield Creek bottoms of Graves county.

Trigg county bottoms are subject to seasonal flooding. Calloway bottoms suffer from wetness and seasonal and intermittent flooding, aggravated by channel sedimentation in Clarks River and its branches. The sediment which originates on surrounding uplands, causes the river and its branches to overflow extensively. Graves county Mayfield Creek bottoms are less subject to wetness and seasonal and intermittent flooding, as the channels are freer of sediment than those in the Clarks River bottom of Calloway county. Further, because Mayfield Creek does not experience the seasonal rises characteristic of the Cumberland River, seasonal flooding is less important there than in Trigg county.

One difference in the farming systems followed in the three bottomland areas should be noted. Calloway bottomland farmers are more extensive producers of popcorn than are farmers in the Mayfield Creek bottoms of Graves county, while Trigg county farmers in the Cumberland bottoms produce virtually no popcorn.

DATA USED AND KIND OF ESTIMATES MADE

For each farm, six different figures were secured:

1. Gross income, which includes the value of all products produced on the farm, including the value of those consumed in the home. The rental value of the farm home, however, was not included.

2. Land inputs were measured in acres. All land was included, whether or not developed, as it is difficult to distinguish in a non-arbitrary way between land capable of being developed for crop or forage production and land completely unfit for grain or forage production.

3. Labor inputs were measured in months of labor on the farm per year, the labor being available for productive use, regardless of the efficiency with which it was used. One object of the study was to find out how efficiently labor was being used. As in the case of land, the distinction between idle labor and productively employed labor is somewhat arbitrary and difficult to make.

4. The forage-livestock investment includes the replacement value of all prennial pasture and hay stands, plus residual fertilizer value, plus the value of the beginning livestock inventory with proportional credits for livestock sold off the farm, and proportional charges for livestock purchased during the year.

5. The machinery investment was the current value of the machinery, tools, and equipment on hand at the beginning of the year, plus proportional additions and deductions for machinery purchased and sold during the year. Each farmer was asked to evaluate separately each item of his machinery.

6. Other expenses include the amounts actually paid for annual seeds; gas; oil; fertilizers whose values are consumed in one year; feed and supplies; custom work; and negative changes in the inventory value of purchased feed, seed, and the like. Expenditures on maintenance of land, machinery investments, and the forage-livestock investment were not included; neither were depreciation charges on these items. 1/

From these data, the earning power of each input or investment was computed statistically. Earning power, as used in this report, refers to the increase in gross income resulting from the last unit of an input or investment used--professional economists use the term "marginal value product" in referring to this quantity. Economists attach particular importance to earning power, because a farmer or business man logically compares the cost of an extra unit of input with its earning power or marginal value product before using more. If earning power exceeds cost, then use of the input is logically expanded; if earning power is lower than cost, then use of the input is logically contracted. Earning power ordinarily decreases as more of an input or investment is used. Thus, the earning power of the last unit of an input or investment is ordinarily lower than its average earnings. Computational techniques, employed in preparing this report yield estimates of earning power which change with the amount of the input used. Thus, the estimates presented in this report are superior to average returns formerly computed by farm management research workers from "dried apple" sheets, and studied with the thermometer-chart technique.

Still further, the earning power of an input or investment depends upon the amount of supporting investments or inputs used with it. The computation methods used in this report also yield estimates of earning power which vary as supporting investments are varied.

One further point should be made concerning the disadvantages of estimating procedures used in preparing this report. When the amounts of two different inputs of investments used tend to increase and decrease together from farm to farm, it is difficult to estimate their separate earning powers. Also, when two or more distinctly different production processes are involved, the estimates may apply to a mixture of the different processes, and not be

1/ Due to the difficulty of determining correct depreciation rates, because of varied maintenance expenses, it is thought best to eliminate these charges. This means that the earning power of machinery, land, and forage-livestock investments must cover such charges.

clearcut for anyone of the processes. As no means of getting around these difficulties other than the exercise of judgment are available without re-sampling, these difficulties are handled, as they arise, on a judgment basis. 1/

TRIGG COUNTY
CUMBERLAND RIVER
BOTTOMS

Bottomland farms in Trigg county, on both sides of the Cumberland River, are included in the sample. In all, financial records for the 1951 calendar year were secured on 32 different farm businesses located in this bottom.

Kinds of Farms Sampled

In this report, the word "usual" refers to a geometric average amount. The geometric average is better than the common average for use in describing a group of farms, as it is less influenced by the few large farms in the sample. The usual or geometric amount, as the word "usual" implies, is more similar to the "great majority" than is the average. The usual Trigg county bottomland farm was organized as follows:

Land used	185.5 acres
Labor used	15.9 months
Forage-livestock investment	$2,912.
Machinery investment	$1,640.
Other expenses	$1,160.

From these inputs and investments, the usual gross income was $3,972.

The picture of the farms studied will be somewhat clearer if the variation among them is described. The lowest gross income was $837, while the highest was $11,686. From the standpoint of acreage, the largest farm had 640 acres, the smallest had 40 acres. A wide range also existed in the amount of labor used--the smallest amount being 6 months and the largest being 40 months. Forage-livestock investments ranged from a low of $209 on one farm to a high of $16,876 on another, while machinery investments ran from a low of $129 to a high of $7,344. The range in other expenses was from $203 to $3,894.

The relationship between the amounts of inputs and investments used, on one hand, and gross income on the other, explains less of the farm-to-farm variations in gross incomes than for any of the six other groups of farms studied. This supports the long-felt conclusion that organizing a Cumberland River bottom farm is both difficult and risky.

1/ Alternative estimating and analytical techniques offer little help, this being especially true of traditional methods of farm-record analysis.

The Earning Power of Land, Labor and Forage Livestock Investments

With 10 more acres of land, an investment of $400 more in seeding, $1,000 more in livestock, and a month more of labor, it is estimated that gross income would have increased by $200 on the usual farm studied. This is a low return for this combination of inputs and investments. As the use of these three inputs and investments were interrelated among the farms studied, it was somewhat difficult to estimate their separate earning powers.

The raw statistical estimates of their earning powers were as follows: land - $.53 ± $3.62 an acre; labor $124. ± $56 a month; and forage-livestock investments, 7.2 percent ± 17.2 percent. Some reasons exist for suspecting that returns to labor are overestimated, and that returns to land inputs and forage-livestock investments are underestimated. Among these reasons are: (1) the tendency for the amounts of land and labor, and the amounts of labor and forage-livestock investments, to change together from farm to farm, and (2) the fact that the estimated earning power of labor is high and the other two are low relative to corresponding estimates on other bottomland farms. Thus, it is concluded that the earning power of land may range from $1 to $8 per acre, that the earning power of labor may be as low as $60 per month, and that returns to forage-livestock investments may be somewhat higher than the estimated 7 percent.

The Earning Power of Machinery

The usual amount of money invested in machinery was $1,640. Its earning power is estimated at 45 percent ± 21.6. There seems to be no reason for suspecting that this figure is biased upward or downward. Apparently, this amount of machinery on 185 acres is reasonable, rather fully employed, and is very important from a timeliness standpoint.

The Earning Power of Other Expenses

Expenditures of Trigg county bottomland farmers on gas, oil, annual seeds and feeds, fertilizers whose values are consumed in one year, custom work, and the like, amounted to $1,160 on the usual farm studied. The earning power of these expenditures is estimated to have been about $1.06 per dollar spent. As no reasons exist for suspecting this estimate to be inaccurate, it is concluded that these farmers have done a rather good job of spending money on these items. Apparently, they spent about every dollar which would return more than a dollar.

The Question of Size and Efficiency

The estimates indicate that efficiency does not change greatly as Trigg county bottomland farms change in size. Some evidence exists that very slight overall increases in efficiency are associated with an increase in size.

CALLOWAY COUNTY
CLARKS RIVER
BOTTOMS

Financial records for the 1951 calendar year were secured for 29 Calloway bottom-farm businesses. The farms sampled were located in the Clarks River bottoms, an area which is subjected to seasonal as well as intermittent flooding from the Clarks River and its branches. Sedimentation in the channel of the Clarks River and its branch-streams makes the losses by flooding unusually severe. This sedimentation problem indicates the necessity of using farming practices on the surrounding uplands which will prevent erosion and further channel sedimentation.

Because of the extensive flooding which makes it difficult to establish and maintain forage stands, a large portion of these bottomlands are employed in the production of row crops, including a considerable acreage of popcorn. Favorable popcorn yields and prices in 1951 contributed toward making 1951 a good year for most of the Calloway farm businesses sampled.

Kinds of Farms Sampled

The farm businesses sampled in the Clark River bottoms showed a considerable range in inputs and investments. The farms ranged in size from 50 acres to 480 acres. The labor used ranged from 12 to 40 months. Livestock-forage investments ranged from $406 to $11,428, and machinery investments from $252 to $6,728. Other expenditures used in combination with these investments and inputs ranged from $160 to $5,729.

The "usual" Calloway bottomland farm was organized as follows:

Land	123.7 acres
Labor	18.2 months
Forage-livestock investment	$1,782
Machinery investment	$1,361
Other expenditures	$ 915

This usual farm earned a gross income of $4,425 (excluding the rental value of the farm home and the costs of the feeder stock purchased during the year).

Farm to farm variations in the amounts of inputs and investment used explained a very large proportion of the farm to farm variations in gross incomes. In fact, 92.6 percent of the farm to farm variation in gross income was explained by farm to farm differences in the use of land, labor, forage-livestock investments, machinery investments and other expenditures. These inputs were measured in the same way as the Trigg county bottomland farms.

The Earning Power of Land, Labor, Forage-livestock Investments and Machinery Investments

The earning power of these four investments, considered as a group, was relatively high. However, as the farm to farm differences in the amounts of these four investments and inputs tended to be related, it proved difficult

to get reliable estimates of their earning powers. The raw statistical computations indicate that the last acre of land used was earning over $13; the chances of an error as large as plus or minus $6.90, occurring in this estimate in a given year, are one out of three. Corresponding estimates for the earning power of the last units of labor, forage-livestock investments, and machinery investments were $47.89 ± 65.76 a month; 9.8 percent ± 29.4 percent; 76.7 percent ± 37.4 percent, respectively. When these estimates are examined in the light of the interrelationship between the amounts of them used on the farms studied, it appears reasonable to the author to conclude that the actual earning powers of these four inputs and investments were about as follows:

Land	$7 to $14 per acre
Labor	$45 - $75 per month
Forage-livestock investments	10 - 15 percent
Machinery investments	around 55 percent

The Earning Power of Other Expenditures

The statistical computations indicate that expenditures on gas, oil, annual seeds, the value of fertilizers used up in one year, custom work, and the like, were around $1.07 per dollar spent. No clearcut reasons exist for suspecting a bias in this estimate. Thus, $1.07 is accepted as an estimate of the earning power of other expenditures on bottomland Calloway county farms.

The Relationship Between Size and Efficiency

When the 29 farms were studied as a group, considerable evidence existed that increases in efficiency occur as Calloway bottomland farms are increased in size. In fact, the estimates indicate that a doubling of the usual farm organization would result in a 118-percent increase in gross income. As this figure is unusually large, the 29 farms were split into two groups. A study of the 17 largest among the 29 farms indicates that efficiency does not continue to increase as size is increased beyond the usual-size farm of this group. The usual farm among the 17 largest studied had a gross income of $7,674. It involved 160 acres of land, 21 months of labor, $2,600 in forage-livestock investments, $2,412 in machinery investments and $1,534 for other expenditures. The indications are that a doubling of this size farm would result in considerably less than a doubling of gross farm income. In fact, the estimates indicate that a doubling of this farm organization would increase the $7,674 gross income by around 86 percent.

In the study of the 17 largest farms, one item of particular interest became apparent. The estimated earning power of the forage-livestock investment was in the neighborhood of 40 percent. Among the bottomland farms studied, this is the highest estimated earning power for forage-livestock investments. It compares favorably with the estimated earning powers of forage-livestock investments on the upland farms. In general, returns to forage-livestock investments have not been as favorable on bottomland farms as on upland farms.

This estimate raises several questions concerning the handling of forage-livestock enterprises on bottomland farms. Some of them follow: Is efficiency in forage-livestock enterprises on bottomland farms closely related to size of operation? Are bottomland, forage-livestock enterprises being handled properly? Are pasture and hay mixtures, adapted mainly to upland farms, being used on bottomland farms? Are low returns for forage-livestock investments on bottomland farms associated with the difficulty of keeping bottomland pastures fenced? Though this study does not offer solutions, it suggests that answers as to why the estimated earning power of forage-livestock investments for this group of larger Calloway bottom farms was so high, might be very worthwhile.

GRAVES COUNTY - MAYFIELD CREEK BOTTOMS

In Graves county, records were taken from 28 bottomland farms located north and south of Mayfield in the Mayfield Creek bottoms. Compared to the Clarks River bottoms in Calloway, the Mayfield Creek bottoms are better drained and less subject to overflow, as the channels contain fewer sediment deposits. And, of course, the smaller Mayfield Creek drainage system is not as subject to seasonal overflow as the Cumberland River bottomland in Trigg county.

Kinds of Farms Studied

In order to ascertain the earning power of land, labor, forage-livestock investments and other expenditures, farms were selected for study, which varied widely in these respects. The smallest farm contained 47 acres and the largest contained 585 acres, while the amount of labor used varied from 12 months to 43. Forage-livestock investments ranged from $1,390 to $24,859 on these farms, while machinery investments ranged from $270 to $6,906; other expenses ranged from $564 to $6,113.

The geometric average or "usual" organization among the farms studied was as follows:

Land	147.7 acres
Labor	18.2 months
Forage livestock investment	$3,758.
Machinery investment	$2,302
Other expenses	$1,523

This usual farm was earning a usual gross income of $5,874.

The Earning Power of Land

According to the statistical estimates, the last acre of the 147.7 acres used on the usual farm was earning $9.96. Though the chances are one out of three that an error as large as $\pm$ $5.57 might occur in this estimate in a given year, no reasons appear to exist for suspecting that this estimate is either high or low.

The Earning Power of Labor

The last month of the 18.2 months of labor, used on the usual farm, earned, $54.62, it is estimated, with a one-in-three chance of an error as large as ± $57.58 occurring in this estimate in a given year. The large probable error results from the small range in the amount of labor used on the farms studied, and a rather close relationship between the amount of labor used and the amount of other inputs used. Despite this large probable error, no reasons are apparent for suspecting that the estimated earning power of labor is biased upward or downward.

The Earning Power of Forage-livestock Investments

The Graves county farms had a relatively large investment in forage and livestock. The estimates indicate that the last dollar of the usual forage-livestock investment of $3,758 was earning a return of about 8 percent, with a one-in-three chance of an error as large as ± 19 percent occurring in this estimate in a given year. There appears to be some reason for suspecting that part of the earning power of the forage-livestock investment is reflected in the estimated earning power of other expenses. Therefore, it is concluded that the earning power of forage-livestock investments is somewhat higher than the raw estimate of 8 percent.

In view of the relatively large forage-livestock investment, this rate of return is quite favorable. In fact, it is the most favorable among bottomland farms studied, with the exception of the 17 large bottomland farms from the Clarks River bottom in Calloway county. The high earning power of forage-livestock investments in the Mayfield bottoms probably results from the fact that the bottoms are rather well drained and not subject to seasonal flooding to as great a degree as are the Clarks River and Cumberland River bottoms.

The Earning Power of Machinery

On the Mayfield Creek bottom farms, the usual investment in machinery was $2,302. The last dollar of this investment, it is estimated, was earning close to 20 percent annually; the chances of an error as large as ± 22 percent occurring in this estimate in a given year are one in three. As no reasons appear to exist for suspecting that this estimate is wrong, it is accepted as the best available estimate of the earning power of machinery of these farms.

The Earning Power of Other Expenses

In addition to the amounts of land, labor, forage-livestock and machinery used, the 28 farmers made expenditures on gas, oil, annual seeds, feed, custom work, and the like. The usual expenditure on such items was $1,523. The raw statistical estimate of the earning power of the last dollar so spent is $1.97, with a one-in-three chance of an error as large 50 cents above or below this estimate occurring in a given year. As previously noted, some reasons exist for suspecting that part of the earning power of the forage-livestock investment

is reflected in the earning power of other expenses. Therefore, it is concluded that the $1.97 estimate is high. Despite this bias, however, it appears that the earning power of other expenditures was considerably higher than dollar for dollar. It is likely that the better drained bottomland farms of Graves county yielded good returns on current expenditures used in the production of field corn and popcorn.

Relationship Between Size and Efficiency

The estimate indicates that efficiency on the Mayfield Creek bottomland farms increases with size. To be more specific, the estimates indicate that a doubling of the usual farm organization would result in a 106 percent increase in gross income rather than the 100 percent increase, which would be expected if increases in size did not increase efficiency. This relationship between size and efficiency is not a normal one in farming; decreases in efficiency ordinarily occur in large part as a joint result of (1) the problems of change, risk, and uncertainty faced by farmers, and (2) capacity of farmers to handle or manage such problems. An upper limit to increases in efficiency probably occurs among the larger farms in the sample.

CONTRASTS AND UNIFORMITIES AMONG THE ESTIMATES FROM THE THREE BOTTOMLAND SAMPLES

To permit comparisons of the estimates for the three bottomland groups of farms, these estimates are assembled in the table below. Those statistical estimates which have been modified on a judgment basis are circled.

Table 1. --Comparison of Estimates for Three Bottomland Groups of Farms.

	Cumberland River, Trigg Co.		Clark River, Calloway Co.		Mayfield Creek Graves Co.	
	Amount	Rate Earned	Amount	Rate Earned	Amount	Rate Earned
Land, acres	185.5	1 to $8	123.7	7 to $14	147.7	$9.96
Labor, months	15.9	60 to $100	18.2	45 to $75	18.2	$54.62
Forage-livestock, dollars	$2,912	7 to 15%	$1,782	10 to 15%	$3,758	8 to 15%
Machinery, Dollars	$1,640	45%	$1,361	55%	$2,302	20%
Other expenses, dollars	$1,160	$1.06	$915	$1.07	$1,523	1.40-1.90
Gross income	$3,972		$4,425		$5,874	

The statistical estimates interpreted on a judgment basis indicate that in 1951 land in the Clarks River and Mayfield Creek bottoms had a higher earning power than in the Cumberland River bottoms of Trigg county. The higher earning power of land in the Clarks River bottom as compared to the Trigg county Cumberland bottoms may be due to the more extensive production of popcorn in the Clarks River bottom as 1951 was a year of favorable popcorn yields and prices. The higher earning power of land in the Mayfield Creek bottoms appears due to better drainage and suitability for cultivation. This

suggests the importance for dredging and controlling sedimentations in the Clarks River area. It is important to note that forage-livestock investments on the uplands surrounding Clarks River had high earning power in 1951[1/] and that if these lands had been farmed in what appears to have been the most profitable way that year, much of the sedimentation problem would likely have been solved.

The earning power of labor does not appear to have varied among the three areas studied. This appears to be even more true when account is taken of the smaller amount of labor used on the Cumberland-bottom, Trigg-county farms.

Forage-livestock investments as handled on these farms do not appear to have been particularly profitable in 1951, which was a good forage-livestock year. In fact, the evidence indicates that returns rarely exceeded 15 percent in 1951. Observation of isolated, apparently very productive, improved pastures on bottomland, coupled with some evidence that high returns were being earned from forage-livestock investments on the 17 largest Clarks River bottom farms, suggests that the problem of getting more profits out of forage-livestock investments on bottomland farms may be one of improper forage-livestock handling. Perhaps the proper fertilization, seeding, pasturing, and harvesting practices for the western Kentucky bottomlands have not been isolated and developed. This may well be true, as both research and extension have tended to be concentrated on upland forage-production problems, with little attention being devoted to bottomland forage-livestock problems.

Machinery investments were paying high returns in all three of the bottomland areas, this being particularly true in the Clarks River area where favorable popcorn yields and prices were received. Machinery probably has high earning on the farms, as (1) the land is well adapted to machine operations, (2) timeliness is important, due to flooding and wetness, and (3) the farm tends to have row-crop acreages sufficiently large to keep the machinery rather fully employed.

Other expenses appeared to be earning good returns in all three of the bottomland areas, with returns in the Mayfield Creek area being the highest.

CONTRASTS BETWEEN EARNINGS ON BOTTOMLAND AND UPLAND FARMS

Three previous upland reports have been issued: Progress Report 1, R & M 60 for Marshall county, Progress Report 2, R & M 60 for McCracken county and Progress Report 3, R & M 60 for Calloway county. Some rather sharp contrasts appear when these reports are compared with the earlier section of this report.

The usual bottomland farm studied was a larger farm, acreagewise, than the usual upland farm. Further, it grossed $4,654 as compared with $4,186 for the usual upland farm.

1/ See Progress Reports No. 1, 2, and 4

On the bottonland farms, returns to machinery tended to be higher than on upland farms, while returns to forage-livestock investments tended to be lower. Bottomland farms tend to be (1) adapted to machine operation (2) subject to wetness and overflow which makes timeliness important, and (3) have row-crop acreages large enough to keep machinery rather fully employed. The low earning power of forage-livestock investments, as previously noted, may be due to production problems, this likelihood being high enough to justify further investigation of these problems by researchers and extension leaders.

Study of bottomland farms in the Trigg county Cumberland bottoms, the Calloway county Clark River bottoms, and the Mayfield Creek bottoms of Graves county indicates:

(1) that the problem of sedimentation in the Clarks River bottom is very important;
(2) that returns to machinery investments are high in all three bottoms;
(3) that returns to forage-livestock investments are relatively low;
(4) as a partial consequence of (2) and (3) above, it is concluded that the input and investment pattern on the bottomland farms is probably about the most profitable one, given the production practices now used.

There is some reason for suspecting that it would be possible to develop forage-livestock production practices, which would make it profitable to devote a much larger portion of the bottomlands to forage-production.