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To the Graduate Council:

I am submitting to you a thesis written by William R. Williams entitled "Adjusting Farm Operation and Organization to Changing Conditions." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

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ADJUSTING FARM OPERATION AND ORGANIZATION
TO CHANGING CONDITIONS

A Thesis
Presented to
the Graduate Council of
The University of Tennessee

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by
William R. Williams
August 1961

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CHAPTER I

INTRODUCTION

Change is the dominant characteristic of the environment in which farmers operate their business. This situation arises from the nature of farming that involves risks and uncertainties, changes in technology, shifts in market demands, fluctuating prices, as well as natural, human, and institutional change. These result in a need for continual adjustments on individual farms in the allocation of available resources to maximize profits and attain or maintain satisfactory levels of living.

The predominance of low-income farmers in the Southeast is evidence that adjustments to change have often been too slow, incomplete, or even lacking in this area, as compared to others. The concentration of farmers with low incomes and low levels of living in the Southeastern states presents a problem and a need for determining the cause of this situation. An evaluation of some of the forces underlying the difficulties in making adjustments provides a background for further study in the area of management. It also helps to reach a better understanding of why farmers do not always follow what scientists consider deliberate patterns in decision making.¹

A major objective of workers in the field of farm management is to present information to farmers, through various means of communications, so that they will be better able to evaluate alternative courses of action in fitting available resources into patterns of production for

¹Glenn L. Johnson and Cecil B. Haver, Decision-Making Principles in Farm Management, Kentucky Agricultural Experiment Station, Bulletin 593 (Lexington: January, 1953), p. 8.

efficient attainment of goals. The process of adopting certain new and improved methods in agriculture, commonly referred to as the diffusion process, is quite slow among farmers in general. Through the years there has been a wide variability in the output and incomes of farms, even on those with an approximately equal resource base. These disparities have apparently resulted from misallocations of resources or a failure to adjust patterns of resource use to changing conditions and technology. An objective of this study is to develop a concept of how more effective use can be made of resources through adjustments to change.

The increasing complexity of a farm business and the uncertainty surrounding the outcome of a particular farm decision makes management the crucial factor in most farm operations. This lack of or incompleteness of knowledge regarding existing production methods, prices and market situations, and expected direction and magnitude of change, often results in a delay of adoption of new technology or a postponement of decision making until more information or knowledge can be acquired.

Bradford and Johnson have stated their concept of management in these words:

Management is an intangible part of production which develops within the lives of men. It is first a mental process, a concentration of desires, a will power. Management functions when a farmer is: (1) observing and conceiving ideas, (2) analyzing with further observations, (3) making decisions on the basis of the analysis, (4) taking action, and (5) accepting responsibilities. Management can be seen only through observing the decision-making process and its results.²

²Lawrence A. Bradford and Glenn L. Johnson, Farm Management Analysis (New York: John Wiley and Sons, 1953), p. 69.

Management factors that are used as a basis for measuring financial success in farming are usually considered "efficiency factors."³ Factors which may be considered include production per unit, capital turnover, income, and labor output per worker. They provide a useful means of determining the efficiency with which a farm is organized and operated. A study of these factors helps to point up strengths and weaknesses in farm programs and are valuable in suggesting adjustments that will influence returns to the farm operation.

I. THE PROBLEM

Statement of the problem. Any attempt at evaluating results of farming operations is quite complex in that many factors, not easily measured in physical terms, enter into the decision-making and action processes of an individual farm family. Woodworth and Saunders have stated the function of management in these terms:

The task of evaluation and choice among alternatives is a function of management. It cannot effectively be delegated to others since intricate systems of conflicting and changing goals and objectives are involved. A high income may be an immediate objective, but the sacrifice which a family is willing to undergo to obtain this income depends on many complex, intangible, yet more fundamental goals.⁴

The manner and efficiency with which an individual farmer makes decisions, takes action, and adjusts to changing conditions has a marked influence on the degree of success in reaching farm or family objectives.

³Andrew Boss and George A. Pond, Modern Farm Management, Principles and Practice (St. Paul: The Webb Publishing Company, 1947), p. 243.

⁴Roger C. Woodworth and Fred B. Saunders, Evaluating Income Opportunities on North Georgia Farms, Georgia Experiment Station, Bulletin N. S. 34 (Athens: cooperating with Tennessee Valley Authority, October 1956), p. 8.

Strand and Heady state that;

Efficiency of agriculture in our country varies in different areas and with different segments of the agricultural economy. In some areas and with some farming systems, efficiency is high; in others it is low. How can we increase the efficiency of our agriculture? One way is to emphasize, more than has been done in the past, opportunities for production and to encourage shifts in resources in areas where efficiency of production is currently low. The consequent improvement of incomes of people in these areas will make for a healthier farm economy.⁵

These facts briefly bring to focus the problem at which this study is directed. The predominance of low-income farms in the South, and more specifically the areas covered by this study, is a pressing problem in the agricultural economy. The misallocation of resources and a failure to adjust properly to changing conditions has contributed greatly to the low-income problem. But these are difficult problems for managers operating in limited-knowledge situations, and especially in cases where the problems may not be recognized. Chastain and Yeager include problem recognition as one of four basic concerns in managerial adjustments. They delineate these tasks as problem recognition, problem solving, action, and responsibility acceptance.⁶

This study describes how selected farm families, cooperating in the Test-Demonstration Program of North Alabama, have adjusted their farming operations to changing conditions. It also concerns conditions that have influenced these adjustments and the resulting effects on farm incomes.

⁵Edwin G. Strand and Earl O. Heady, Productivity of Resources Used on Commercial Farms, Iowa Agricultural Experiment Station, Technical Bulletin No. 1128 (Ames: November 1955), pp. 2-3.

⁶E. D. Chastain and Joseph H. Yeager, Farm Management Concepts and Principles with Application to Southern Agriculture (Auburn: 1958), p. 8.

Statement of the objectives. It is the purpose of this study: (1) to describe how selected farmers have adjusted farming operations to changing conditions over a thirteen-year period of time, (2) to measure the effect of adjustments in farming operations on net returns to farm operators, and (3) to ascertain the effects of adjustments on efficiency in farm operations.

Importance of the study. A number of agencies in the field of agriculture are problem oriented in that their major objective is to help farmers develop systems of farming that will provide satisfactory incomes and levels of well-being. The persistence of low incomes in the Southeast emphasizes the need for adjustments in resource use patterns on many farms to attain this goal.

Most farms are organized on the basis of experience and observations of the individual operator. The operators have remained in the area or region in which they received their experience and education. Therefore, by nature and training these operators are inclined to follow well-established resource-use methods peculiar to their area and are conservative in risk-taking situations.⁷ Demonstrations and first hand knowledge of experiences of other farmers are two of the most effective means of promoting adjustments in farm programs. Information of this nature is useful material for agricultural leaders working directly with farm people since it is based on, and represents, actual experiences of farm families.

⁷Bradford and Johnson, op. cit., p. 69.

It is recognized that farm organizations depend on a number of conditions at any given time such as available capital, technology, individual abilities including health and mental attitudes, equity in the farm business, objectives in farming, price relationships, personal preferences, and knowledge of farming. It is a change in one or more of these conditions, over time, that gives rise to a need for adjustments in the farm organization. More capital becomes available through savings, new methods of production are developed, a farmer's goals change with increasing age and deterioration of physical abilities, prices rise and fall at different rates, new markets are developed and old markets cease to function; it is the function of the farm manager to adjust or not to adjust to these changing conditions.

The needs for improving managerial abilities, improving efficiency, and adjusting operations to change are not a matter of choice, but rather a necessity for farmers who hope to continue to receive satisfactory incomes from farming operations. Many successful farmers of a few years ago are no longer successful because of a failure to adjust to changing conditions.

Even the well-informed modern farmers are likely to have their businesses upset by invention and technological developments, which render investments in machinery, buildings, and equipment obsolete and their existing knowledge more or less out-of-date.⁸

Thus it is important to know more about the nature of changes which farmers are continually experiencing and the subjects about which farmers need to learn.

⁸Bradford and Johnson, op. cit., p. 19.

Procedure. The procedure used in this investigation is that of a case study method of analysis and is based on individual test-demonstration farms in the Tennessee River watershed area of Alabama. Two of the farms are located on the Appalachian Plateau in Marshall County and two in the Limestone Valley region of Colbert and Limestone Counties.

This study covers a thirteen-year period from 1948 through 1960 and is based on annual farm and home records furnished by these cooperators in the test-demonstration program. These records are summaries of the years' farm operations that reflect, in general, the business accounts, including costs and incomes.

Each farm has been analyzed and data summarized on an annual basis, in order to observe adjustments made in farm operations and measure actual results in terms of changed incomes.

The procedure followed included an analysis of change in land use and output, livestock production and output, uses of commercial fertilizers, farm expenses, labor force, and capital investments. The relationship of adjustments in these areas and the resulting effects on returns to the operator are summarized for each case farm.

The study is addressed to such questions as, what has occurred to bring about adjustments on these farms, and what results have adjustments had on the efficiency of farming operations, on volume of business, and on farm incomes?

II. RELATION OF THE STUDY TO ADJUSTMENT PROBLEMS

The use of case studies naturally limits the scope of investigation to the physical resources and the level of managerial ability on the farms

under consideration. These resources, admittedly, would not be available in the same quantity or quality on all farms even of the same general area. To utilise this type of study in the analysis of general problems in decision-making and adjustment would involve shifting from the specific to the general or to use an individual case to predict the effects of adjustments on a number of farms. Some would possibly criticise this approach on the basis that it deals only with what has happened and why it has happened and does not suggest solutions to existing problems. Perhaps others would argue that budgeting would provide more meaningful data regarding adjustments for profit maximisation, placing emphasis on what "ought to be" rather than "what is". Indeed, these are valid arguments in that farmers must plan for the future and make adjustments on the basis of limited knowledge as to future conditions under which they will operate their business. Yet, in retrospect, we find meaningful results of adjustments made under actual conditions which reflect more nearly the actions of entrepreneurs operating in imperfect-knowledge situations. A knowledge of these actions will give some insight into the human factors involved in risk-taking situations. It could be further argued that farmers do not always operate in profit maximising situations. Attitudes and values are reflected in decision-making processes, and often have a greater bearing on actions than does the objective of increasing real income.⁹ The budgeting process does indicate possible resource combinations for increasing farm incomes, and linear

⁹Eugene A. Wilkening, Acceptance of Improved Farm Practices in Three Coastal Plains Counties, North Carolina Agricultural Experiment Station Bulletin 98 (Raleigh: May 1952), p. 10.

programming is designed to delineate "best" combinations for profit maximization. However, a great deal is assumed regarding managerial abilities, skills in adopting new techniques, and human behavior in risk-taking situations. The case study is a method of pointing up these factors involved in adjustments to changing conditions to the degree that they will be more meaningful in the prediction of results in planning future adjustments. But we do not live in a static society, and it is not unreasonable to assume that attitudes and values will change as new knowledge is acquired and new skills are developed through farmer experiences. Actually, it is felt that a study of this nature can be used to speed up this educational process.

In any study of resource utilization one is sooner or later confronted with the concepts of micro- and macro-analysis. Quite often the two bring about conflicts in results because what appears best for the individual farmer may be in direct opposition to what is best for the aggregate of farmers. For example, the individual farmer may feel that it is desirable to produce at full capacity of resources to the point of economic optimum. Yet, by principles of macro-economics, which deals with aggregate supply and resulting effects on price, we find that perhaps farmers should produce less. However, any solution to this problem will of necessity be based, in part, on managerial practices of individual farmers.¹⁰

¹⁰Bradford and Johnson, op. cit., p. 429.

This case study is not intended as a complete answer to how farmers in general make adjustments or the effects that certain adjustments would have on any other particular farm business.

There is a tendency to forget that, regardless of the mass of data collected on a few cases, deductions are extremely dangerous, if not impossible. The subjective data gathered by case study methods do not lend themselves to quantitative check; sampling is often omitted, and thus the formulated generalizations may have been based on data which represent atypical cases.¹¹

Richard G. Wheeler advances a rather clear concept of the usefulness of case studies:

The farm management worker cannot hope to provide ready-made solutions for even the most important problems on each individual farm. But, extensive analysis in terms of operating units will demonstrate appropriate ways of attacking particular problems; moreover, the results can be altered slightly to fit many situations similar to the one actually analyzed. Extending the number to include an appropriate sample of a particular group of operating units illustrates a technique for moving from micro-economics toward macro-economics, or from partial equilibrium analysis toward general equilibrium analysis. Such studies may be useful in formulating public, as well as private, policy.¹²

¹¹Pauline V. Young, Scientific Social Surveys and Research (New York: Prentice-Hall, Inc., 1956), p. 236.

¹²Richard G. Wheeler, "New England Dairy Farm Management Project as an Example of the Operating Unit Approach to Farm Management Analysis," Journal of Farm Economics, Vol. XXXII, No. 2 (May 1950), p. 215.

CHAPTER II

PHYSICAL AND ECONOMIC CONDITIONS IN THE AREA OF STUDY

I. RESOURCE USE

Adjustments in agriculture are determined to a large degree by the physical and economic conditions surrounding the farm region or a particular farm. Physical conditions place limits on the choice of enterprises and influence capital requirements in production, while economic conditions, both local and national, have a marked effect on market demands and prices and consequently on the kinds and quantities of products that farmers produce.

During the 1950's farm output in the U. S. increased at an annual rate of nearly 2.25 per cent. During this same period production costs of farmers tended higher and prices received for farm commodities declined from the peak reached during the Korean War. This situation of increasing costs and decreasing prices resulted in increased pressures on the farm population to adjust uses of farm resources in directions which would result in increased efficiency, to adjust standard of living to decreased real income or to seek employment elsewhere, either on a full-time or part-time basis.

The results were a decreased number of commercial farms with increased volume of business and an increased number of part-time farmers and industrial workers. The relative movements of farm costs and farm prices from 1948-60 are shown in Figure 1.

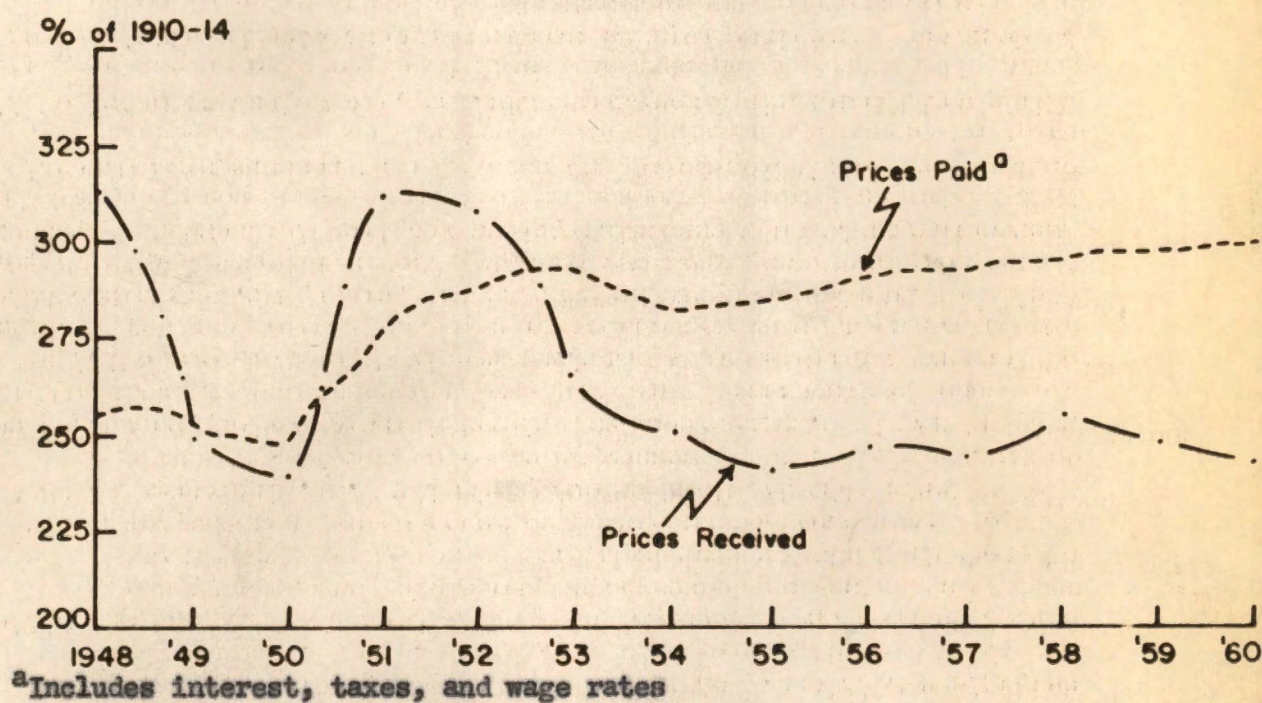


FIGURE 1

TRENDS IN FARM PRODUCTION COSTS AND FARM PRICES,
UNITED STATES, 1948-60
(FROM AGRICULTURAL OUTLOOK CHARTS,
1960, UNITED STATES DEPARTMENT
OF AGRICULTURE)

This investigation is concerned with farms of the Tennessee River drainage area of Alabama, which comprises fifteen northern counties in four major soils regions. These are the Limestone Valley, Appalachian Plateau, Highland Rim, and the Upper Coastal Plains. Since most of the agricultural production of this drainage area comes from the Limestone Valley and Appalachian Plateau soils areas, this study will deal only with these two regions. A map of the general area and location of case farms is shown in Figure 2.

The average annual precipitation in the Limestone Valley and Appalachian Plateau is 52.35 inches with about 60 per cent of this normally occurring during the six-month period of November through April. Occasional prolonged droughts occur during the crop-growing season, which can result in considerable loss to the farmers. Extreme droughts occurred during the crop-growing seasons of 1952 and 1954, which results in relatively low yields of most crops (Appendix A). The average length of growing season in the two areas is about 205 days.

II. PHYSICAL CONDITIONS OF THE LIMESTONE VALLEY REGION

The Limestone Valley lies adjacent to the Tennessee River and its tributaries. Parts of seven counties, Colbert, Jackson, Lauderdale, Lawrence, Limestone, Madison, and Morgan, make up the major portion of this North Alabama region. Soils are derived from almost pure limestone and are of the Dewey, Decatur, Abernathy series. These red and brown clay loams are deep soils that are mostly level to slightly rolling and occur as relatively large, uniform fields. The Limestone Valley soils are among the best in Alabama. They are inherently fertile, well adapted to a

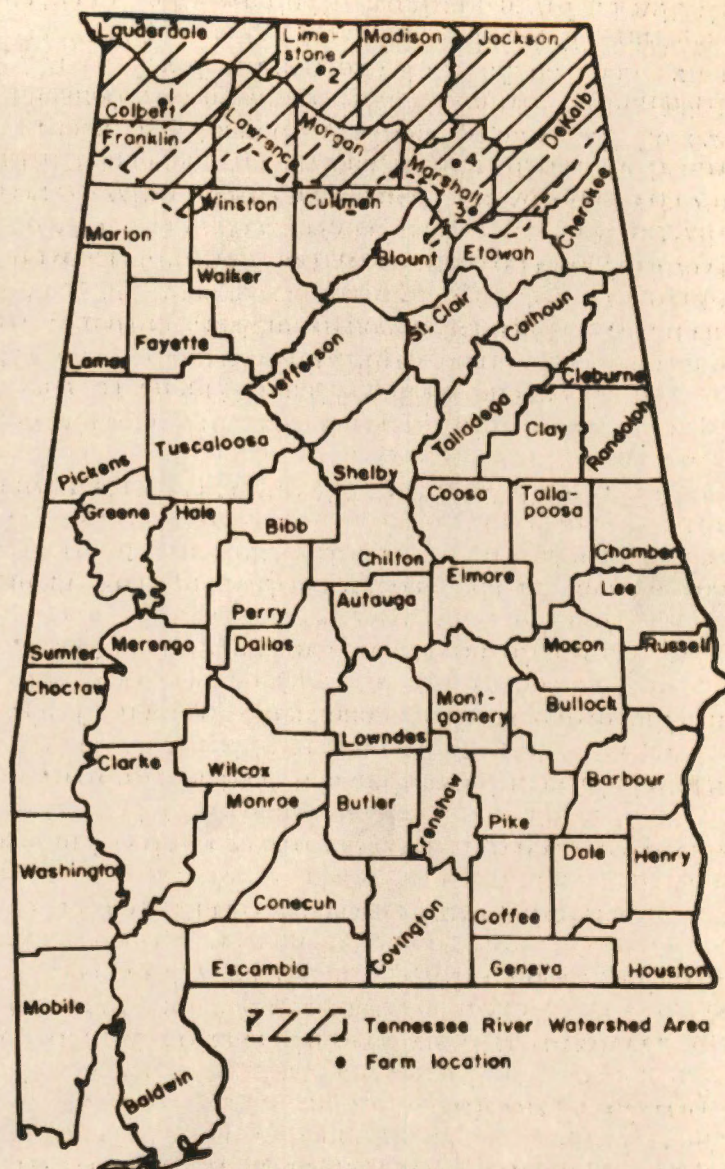


FIGURE 2

TENNESSEE WATERSHED AREA AND LOCATION OF CASE FARMS

variety of crops, usually not too severely damaged by erosion, and generally respond well to good management. Most of the land is in relatively large farms and is farmed mainly by tenants or hired labor with the owner supervising.¹

The Limestone Valley soils respond well to fertilization. Mineral fertilizers, for major crops grown, are required in a one to one ratio. A recent study of five thousand soil samples from the area showed that 89 per cent required an even phosphate-potassium ratio.²

The climate is temperate, having an average range of approximately 35°F. between the summer and winter temperatures. The average dates of the earliest and latest killing frosts are October 25 and March 20, respectively. The average length of growing season is two hundred days and average precipitation is about fifty-five inches annually, with the least rainfall occurring during the fall months.

III. ECONOMIC CONDITIONS OF THE LIMESTONE VALLEY REGION

In recent years the Limestone Valley Area has been the state's fastest growing industrial area. The plentiful water supply, hydro-electric power, water transportation, and the relatively plentiful supply of labor have contributed substantially to this increased industrialization. Total population of the Limestone Valley Area increased about 11 per cent during the period 1950 to 1960 while that for the state increased 6.7 per

¹L. G. Bracheen, Soils of Alabama, Soil Survey, Department of Agriculture and Industry (Montgomery: 1953).

²W. F. Sowell, Alabama Soil Test Summary, Unpublished data, Auburn University (Auburn: 1960).

cent. Industrial employment increased 2½ per cent and per capita income rose an average of \$4½ during this period. Much of this was due to the increased industrialization and a shift from farm to industrial employment.

Railroad transportation facilities are good. One railway facility traverses the Valley from east to west, passing through Colbert, Morgan, Madison, and Jackson Counties, connecting the area to Chattanooga to the east and Memphis to the west. Another system crosses the Valley from north to south at both Florence and Athens, connecting these areas to Nashville to the north and Birmingham to the south.

The area is well supplied with highways, being traversed from both north to south and east to west by several U. S. highways. Numerous asphalt-surfaced roads traverse the area serving as farm to market roads.

Water transportation is furnished the area by the Tennessee River. Loading docks and terminal facilities are available at Florence, Sheffield, Decatur, Huntsville, and Gunterville.

Major crops of this area are cotton, corn, and small grain, while the important livestock enterprises are beef cattle, hogs, and dairying. Cotton accounts for about 60 per cent of the agricultural income of the area while various livestock account for about 35 per cent. Trends in recent years have been toward increased livestock production, predominantly beef cattle. Agricultural census data show that numbers of cattle in this area have increased 6½ per cent since 1950. The number of farms have decreased 3½ per cent while farm size increased 3½ per cent and number of tenants decreased 29 per cent between 1954 and 1959 (Table I).

Markets are well established for most farm products now being produced in the area. Gins located throughout the area provide markets

TABLE I

PHYSICAL AND ECONOMIC CHARACTERISTICS OF THE LIMESTONE VALLEY,
APPALACHIAN PLATEAU AND STATE OF ALABAMA

Item	Unit	Limestone Valley	Appalachian Plateau	State
Changes 1954-59:				
Number Farms ^a	Per cent	-34	-32	-34
Number Tenants	Per cent	-29	-25	-20
Farm Size	Per cent	34	8	22
Selected Characteristics 1959:				
Farm Size	Acres	128	65	143
Commercial Farms ^a	Per cent	53	64	50
Part-time Farms ^b	Per cent	36	28	35
Income from Crops	Per cent	65	58	—
Income from Livestock	Per cent	35	40	—
Crop Yields per Acre:				
Cotton 1949	Pounds lint	251	219	—
Cotton 1954	Pounds lint	485	538	—
Cotton 1959	Pounds lint	489	525	—
Corn 1949	Bushels	26.8	29.1	—
Corn 1954	Bushels	32.8	37.0	—
Corn 1959	Bushels	29.5	32.2	—

^aDefinition of a farm used was that of the 1959 Agricultural Census, 1954 data were adjusted to the 1959 definition.

^bFarm classification according to 1959 Census. Data are shown as a per cent of total number of farms.

for cotton on a grade basis. Cotton buyers are located in all county seat towns. Grain elevators are located at Florence, Decatur, and Gunterville, with several buying stations located throughout the area. At least one livestock auction establishment operates in each county one day per week and a number of small packing houses are located in the area. Two poultry dressing plants are also located in the area, and a number of feed companies market both poultry and eggs on a contract basis.

These trends and economic conditions have had considerable influence on adjustments in the agriculture of the area. The decreased farm labor supply and increased local demands for farm products have been the most important local forces bringing about farm adjustments.

IV. PHYSICAL CONDITIONS OF THE APPALACHIAN PLATEAU REGION

The Appalachian Plateau Region of Alabama, commonly known as the Sand Mountain Area, is made up largely of five North Alabama Counties, namely, Blount, Cullman, Etowah, Dekalb, and Marshall. The gray to brown fine sandy loam soils are of sandstone origin and are not as inherently fertile as soils in the Limestone Valley Area. Hartsells, Enders, Linker, and Hanceville are the major soils with Hartsells predominant in the area. They occur on gently rolling to rolling relief, necessitating extensive use of terraces for erosion control. Soils are shallow, ranging in depth from about thirty to fifty inches. These soils constitute the most intensive row-cropped area of the state. They are easy to cultivate, respond readily to good management, and are well adapted to a large

number of crops. Farmers of this area are normally heavy users of commercial fertilizers and crop yields are considerably above average for the state. Cotton, corn, and vegetables are the principal crops, while poultry, hogs, and dairying are the important livestock enterprises.

The area is located in the warm temperate zone having a mean temperature of about 62°F. The average rainfall is about fifty inches annually with the heaviest precipitation occurring during the winter and spring months and the lightest during late summer and fall. The average frost-free season is 210 days. However, this may range from 190 to 240 days.

V. ECONOMIC CONDITIONS OF THE APPALACHIAN PLATEAU REGION

Farm population in the Sand Mountain Area is dense, with land ownership ranging mainly from twenty to one hundred acres per farm. The average size of farm is about sixty-five acres. Farm families perform most of the work, as contrasted to the Limestone Valley Area where heavier dependence is placed on tenant and hired labor. Enterprises usually consist of some combination of crops and livestock. Cotton production is the major source of cash receipts, constituting about 50 per cent of farm income, with poultry making up about 25 per cent.

Recent trends have been in the direction of fewer farms, with the number of farms decreasing 32 per cent and size of farms increasing 8 per cent from 1954 to 1959. Sixty-four per cent of the farms are operated on a commercial basis and 28 per cent as part-time farms. The number of tenant-operated farms declined 25 per cent from 1954 to 1959. Total

population of the area has remained about the same for the past ten years, with industrial employment increasing approximately 55 per cent and per capita income up an average of \$360.

Transportation facilities, including railways, water, and highways, are good in this area. The docks on the Tennessee River at Gunterville form the central shipping point for many products transported by water to all areas of the South. Railroad facilities traverse the area from north to south, passing through both Gunterville and Cullman and from east to west passing through Blount, Etowah, and Dekalb Counties. Numerous asphalt-surfaced roads make local markets easily accessible to all sections and several U. S. highways cross the area connecting it with all major markets.

Markets for crops include grain elevators at Gunterville and grain buying stations located in all counties. Ginners and cotton buyers purchase cotton on a grade basis and vegetables are marketed locally through contracts with canneries and at large retail and wholesale markets in Gadsden and Birmingham.

Livestock auction markets are located in each county and are usually operated one day per week for sale of cattle and six days per week for hogs. Six poultry dressing plants are located in the area and the bulk of eggs produced are marketed by feed-and-poultry concerns on a contract basis.

CHAPTER III

ANALYSIS OF LIMESTONE VALLEY CASE FARMS

I. INTRODUCTION

The four case farms selected for study were cooperators in the Joint Extension Service-Tennessee Valley Authority Cooperative Test-Demonstration program during the entire thirteen-year period, 1948-1960. Records of costs and returns and farming practices used were available for the entire period for each of the farms. These farmers have had some advantage in gaining knowledge of production practices and making management decisions because of the educational service available to them through the Test-Demonstration program. These farmers also received limited amounts of experimental fertilizers at reduced cost for use in testing and demonstrating fertilizers and fertilization practices. However, for purposes of farm accounts all fertilizer costs are charged at commercial rates for equivalent plant food in comparable form.

The Test-Demonstration program is a cooperative undertaking involving the Tennessee Valley Authority, participating farm families, and the Land Grant Colleges. The demonstration technique is generally recognized as an important and effective educational method for disseminating practical farming methods and techniques. Activities in this program involve the testing and demonstrating of fertilizers and fertilization practices, but embrace total resource development, emphasizing educational processes and recognizing the farm family as a basic decision-making unit. The farm family, with the aid of Extension personnel, inventories resources

and develops long-range plans as a guide in making necessary adjustments for reaching the family goals. Annual plans for use of land, capital and labor resources are developed as intermediate steps in the long-range plan.

This farm-unit approach provides flexibility for adjustments since long-range plans are revised annually and managers have assistance in obtaining information with regard to alternative uses of resources. However, the assistance given the family is strictly of a counseling nature, and decisions for adjustments in farming operations, financing the program, and responsibilities for risks involved rest with the farm family.

II. ADJUSTING USE OF FARM RESOURCES

Land use is an important part of any farm organization and adjustments in land use have a direct effect on uses made of other resources, such as labor, machinery, capital, livestock, and buildings. Government policies place limits on certain land uses and often result in problems of diverting acreages to production of unrestricted crops or other uses. Livestock programs are restricted to some extent by land use and the total feed-production capacities of the land use program. Labor requirements for different enterprises vary, not only in total amount required, but also in distribution of labor required during the year. On the other hand, labor supply available may be rather constant from one period of the year to another. Thus, the total amount and seasonal distribution of labor available and labor required by different enterprises in the aggregate act as limits or restrictions on feasible adjustment alternatives.

Shifts in enterprises often necessitate additional capital outlay for machinery, buildings, and fences. Since additional capital is not always available or the farmer may be reluctant to incur additional debt, adjustments in the farming program may be delayed or spread over time, to reduce the necessary capital expenditure in any one year. Changes in enterprises may require new knowledge and skills in management of additional or different farm activities. The lack of knowledge, or incomplete knowledge, with regard to particular production and management practices may result in failures to adjust, or to a delay in making adjustments in enterprises or practices. A farmer often postpones a decision until additional knowledge is obtained. Slowness in the information dissemination process, itself, often results in considerable lag between acquisition of new knowledge and actual on-the-farm adoption.

Changes in machinery and equipment used are closely related to changes in the cropping system, production methods, livestock enterprises, labor availability, and alternative opportunities for use of labor. Several years may be required to accomplish the most profitable degree of mechanization for a particular combination of enterprises because of high capital requirements or incomplete knowledge with regard to machinery use and/or incomplete knowledge regarding the profitability of making additional investments in machinery.

As improved production practices are developed through research, the progressive farm manager attempts to adopt those practices that will result in more efficient production. Often considerable time is required to learn the new skills and to adjust other resources such as machinery, labor, and land to the new practice or technique.

III. ANALYSIS OF CASE FARM 1

General description. The first case farm to be analyzed is a relatively large diversified farm located in Colbert County, Alabama. The operator, who presently is fifty-eight years of age, completed eight years of school. He has lived on this farm most of his life and for a number of years operated two hundred acres of land on a partnership basis with his father. The farm was predominantly a cotton farm until about 1945 when grade cattle were added on a small scale. Farm acreage was increased to 486 acres in 1947 when the operator's father retired and the son assumed management of a larger part of the farm under a partnership agreement. An additional 186 acres were added to the farm operation in 1954. This expansion was made by purchase of 110 acres of adjoining land and through agreement for the operation of the remainder of the father's farm.

The farm is in one of the better farming communities and soils are among the best in the Limestone Valley Region. The soils are predominantly of the Decatur and Dewey series with a few small areas of Abernathy soils. Much of the land is in relatively large level fields, but there are small areas that are rolling and stony. Eighty acres are terraced and are used mainly for production of sod crops.

The labor force is made up almost entirely of tenant families who operate part of the crop land on a share basis and work part-time for the manager as day labor at prevailing wage rates in the community. Very little family labor, other than that of the operator, has been involved during this thirteen-year period.

This farm family consists of the operator, his wife, and one daughter. All members have been very active in community and county programs of an agricultural or home economics nature.

Changes in land use. Cotton has been a major cash enterprise throughout this period and acreages devoted to this crop have usually been the maximum allowed by the governmental cotton allotment program. Most of the cotton acreage has been operated by tenant families on a share basis. Other than acreage changes necessitated by changes in allotted acreage, adjustments in cotton production have been limited to changes in production and harvesting practices directed toward increased yields and quality of cotton. Acreage devoted to cotton increased from an average of 118 acres in the 1948-50 period to 135 acres in the 1953-55 period and decreased to an average of 89 acres in the 1958-60 period. Changes in acreage of various crops over the thirteen-year period are shown in Table II.

During the thirteen-year period acreage devoted to corn production increased considerably. Corn acreage averaged 34 in the 1948-50 period, 58 in the 1953-55 period, and 137 in the 1958-60 period. Increased corn acreage resulted partly because of reduced cotton allotments, and partly by a need for more grain in the expanded livestock enterprises.

Small-grain acreages, primarily wheat, almost doubled during the period. Acreage devoted to small grain increased from an average of 102 in the 1948-50 period to 197 in the 1958-60 period. Wheat acreage increased from 28 to 113 in corresponding periods. Three factors have possibly influenced change in small-grain acreage. These include a more

TABLE II

LAND USE ON CASE FARM 1, AVERAGE FOR 3 PERIODS OF 3 YEARS EACH

Land use	1948-50 Acres	1953-55 Acres	1958-60 Acres
Cotton	118	135	89
Corn	34	58	137
Wheat	28	74	113
Oats and barley	74	108	84
Alfalfa	17	19	35
Sericea	15	15	15
Grain sorghum	16	45	3
Lespedeza	90	0	0
Improved pasture	25	75	83
Winter legumes	60	67	20
Winter grazing mixtures	29	60	16
Silage	17	0	0
Truck crops	5	2	0
Sudan or millet	0	0	18
Total cropland used ^a	528	658	613
Open land ^b	452	577	577

^aAcres of cropland used exceeds total acres due to double cropping.

^bAcres of open land increased to 577 in 1954 as a result of purchase of 110 additional acres.

favorable market through development of a local cooperative grain elevator, more favorable weather conditions, and developments in mechanization which have reduced labor requirements in production and harvesting of small grain to a greater extent than for other cash crops. These crops have also fitted well into the winter grazing program for the expanding hog and beef cattle enterprises.

The use of land for production of grazing and forage crops has been shifted toward more improved pastures, alfalfa, and temporary grazing crops, replacing lespedeza and silage as feed and grazing for the beef cattle herd.

Serecia has remained in the land use program to utilize areas unsuited to most other crops and to supply grazing during extremely dry summer and fall periods. Mixtures of winter grasses and legumes were important during part of this period as a source of feed for cattle, but in more recent years much of the need for winter grazing has been supplied by the increased acreage in small grains that are normally grazed until about March first.

Grain sorghum production has been dropped from the land use program. Low yields were apparently the major reason for discontinuing the use of this crop.

Sweet potatoes were produced on a small scale early in the period, but were discontinued in 1955. The high labor requirements for sweet potatoes, seasonal competition for labor with the cotton crop, and reduced sweet potato prices were possibly reasons for this change.

Changes in crop yields. Crop yields tended to be somewhat higher in the latter years of the thirteen-year period, but have been highly

variable from one year to the next. Weather conditions apparently had a greater effect on yields than did changes in production practices. Rather severe droughts occurred in 1952 and 1954 and less severe localized droughts occurred in 1953, 1959, and 1960. The effect of these drought conditions on yields was most apparent in the case of corn (Figure 3). No doubt, changes in practices also contributed to increase in yields, particularly in the case of cotton and wheat. Cotton yields for the first six years of the thirteen-year period averaged 422 pounds of lint per acre, as compared to 527 for the last six years. Neither of these periods included 1954 which had an extreme drought during the growing season and accounted for the low yield of that year. Corn yields improved slightly, as indicated by an average yield of thirty-seven bushels per acre for the first six years and forty bushels for the latter six. Also it should be noted that acreage devoted to corn was more than doubled for the latter six-year period.

Wheat yields averaged 25.5 bushels per acre for the thirteen-year period. The average yields were 20 bushels per acre for the first six years of the period and 31 bushels for the last six years, with average acres changing from 41 during the first six years to 129 for the last six.

Changes in commercial fertilization rates. The operator of this farm made a number of changes in use of both ratios and rates of commercial fertilizer materials. These changes are more pronounced for certain crops than for the farm as a whole.

Total fertilizer use measured in terms of total plant nutrients fluctuated considerably from year to year. The highest amount used was

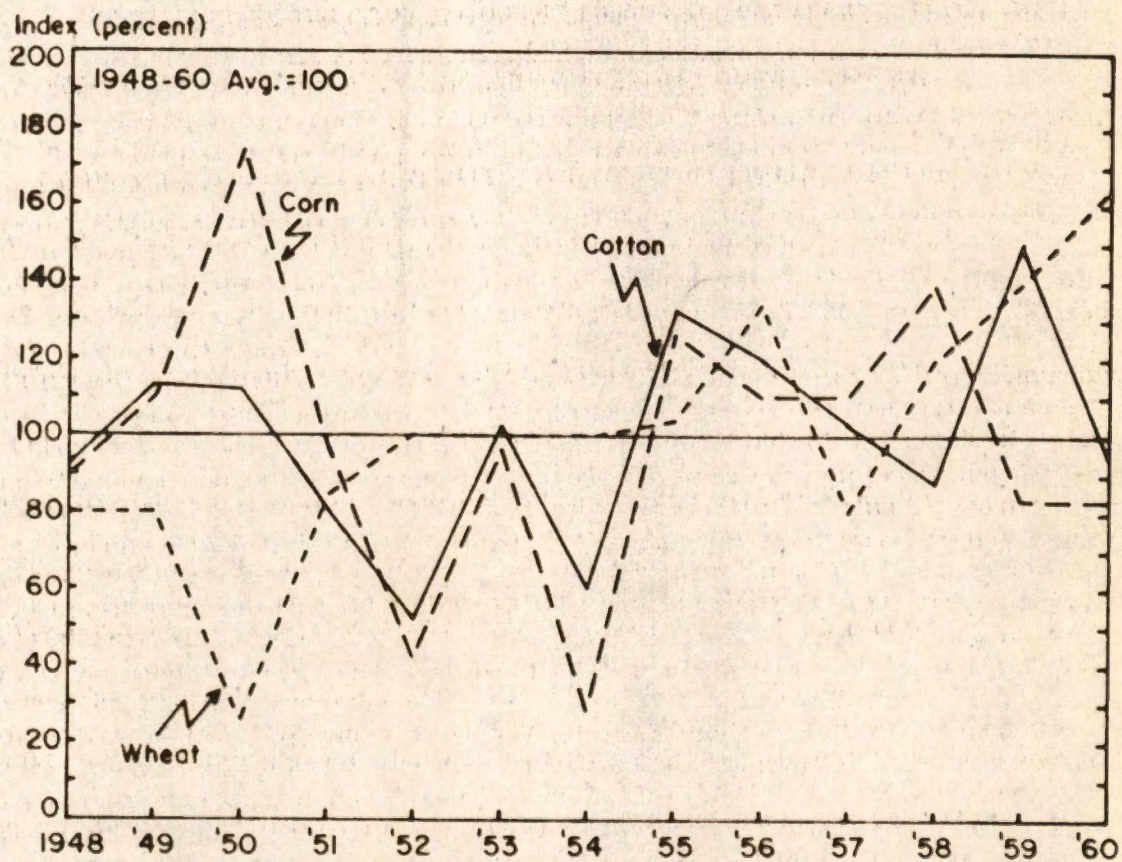


FIGURE 3

INDEX OF CROP YIELDS, CASE FARM 1, 1948-60
 (BASED ON THIRTEEN-YEAR AVERAGE YIELDS
 FOR EACH CROP ON THIS FARM)

146 pounds per open acre in 1960, as compared to the lowest of 73 pounds for 1948. During nine of the thirteen years, ninety pounds or more of plant food were used per open acre (Figure 4). However, the most significant change, on a total farm basis, was a shift beginning in 1956 to a more nearly balanced use of phosphate and potassium nutrients.

Apparently, more emphasis was placed on improved fertilization of the high value crops than for the entire farm. This is indicated in both ratios and rates. During earlier years of the period all crops received a relatively low application of potash nutrients, while in later years potash and phosphate were applied at about equal rates (Figure 4). It is rather difficult to measure values of legumes grown in terms of nitrogen. Improvements in the use of commercial nitrogen during the latter years could have easily been off-set by the larger acreage of winter legumes grown in earlier years.

Table III shows yearly applications of nutrients for cotton, corn, and wheat on this case farm.

Changes in the livestock program. The livestock program on this farm has consisted mainly of beef cattle, with hogs growing in importance in the last four years. Other types of livestock were kept primarily to provide family food supply.

In beef production the operator used the cow-calf system with calves being sold at weaning either as slaughter calves or as stocker cattle. Number of brood cows have ranged from forty-eight head in 1955 and 1956 to sixty-seven head in 1951. Disease problems were encountered in the beef herd in 1955 which made it necessary to replace almost the

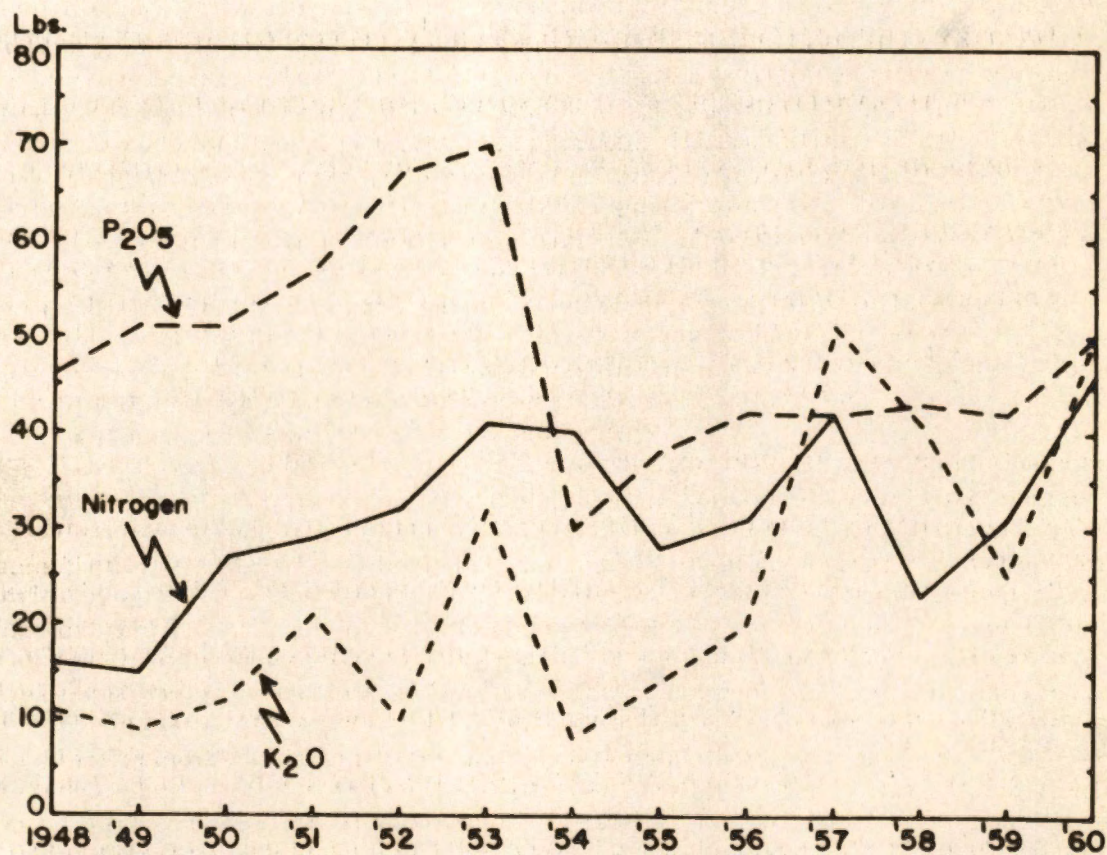


FIGURE 4

ANNUAL APPLICATION OF PLANT NUTRIENTS
PER OPEN ACRE, CASE FARM 1

TABLE III

APPLICATION OF COMMERCIAL PLANT NUTRIENTS PER OPEN ACRE,
IN POUNDS, SELECTED CROPS, CASE FARM 1

Year	COTTON			CORN			WHEAT		
	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
1948	24	32	16	3	8	5	33	10	0
1949	24	32	16	28	10	7	16	0	0
1950	23	31	16	67	22	11	37	10	7
1951	26	35	18	45	16	8	44	10	7
1952	27	36	18	51	25	18	42	20	14
1953	33	44	22	77	25	18	51	20	14
1954	33	55	22	32	25	18	35	4	3
1955	20	60	60	42	25	18	58	20	14
1956	39	45	32	30	25	22	50	25	25
1957	42	42	42	48	24	24	63	41	41
1958	57	72	72	62	36	36	59	48	48
1959	67	59	66	29	44	30	65	43	45
1960	56	72	72	60	36	36	70	48	48

entire herd. This resulted in only a 75 per cent calf crop in 1955 and, thus, an extremely low return from cattle in 1956 (Table IV).

Hogs have become an important source of farm sales in recent years. During the early years of this period hogs were kept primarily for home production. This enterprise appeared to be neglected or improperly managed until 1958 or 1959, as indicated by pigs raised per sow. The number of sows kept changed from 1.5 in 1948 to 17 in 1960, with no more than 3 sows in the herd prior to 1957 (Table IV).

Livestock enterprises in terms of brood stock, numbers sold, and efficiency in production are shown in Table IV.

Changes in labor force and labor efficiency. The available labor force on the farm has been fairly constant during the thirteen-year period. It has consisted of the manager and six tenant families for the entire period. Two additional families lived on the farm in 1955 and 1956 and three additional families during 1957 and 1959. These additional families provided some day labor but received their major income from other sources. Two of the tenants who were on the farm during the entire period were somewhat incapacitated due to age and physical handicaps.

The major change in the labor program has been increased efficiency. Volume of business as measured by productive man-work units¹ remained relatively constant while labor efficiency, as measured in terms of productive man-work units per man, increased from a low of 17½ days in

¹Productive man-work unit is the average amount of work done by a man in a ten-hour day.

TABLE IV
LIVESTOCK PRODUCTION AND RELATED FACTORS, CASE FARM 1

Year	Number beef cows	Per cent calf crop	Number other cattle	Number cattle sold	Number sows ^a	Number pigs raised per sow	Number hogs sold
1948	50	94	24	45	1.5	15.3	5
1949	53	100	36	24	1.5	13.0	12
1950	63	77	43	36	2.0	12.0	25
1951	67	89	45	54	3.0	7.0	20
1952	66	100	58	43	3.0	15.0	31
1953	66	110	62	80	2.5	5.5	20
1954	61	85	54	67	2.5	9.5	32
1955	48	75	56	42	3.5	10.0	21
1956	48	100	60	23	3.0	10.0	30
1957	53	86	57	65	5.0	10.0	50
1958	54	109	50	45	12.0	12.0	83
1959	50	96	61	47	14.0	16.0	179
1960	51	100	52	50	17.0	15.7	251

^aSows are considered as gilts or sows kept for twelve months or more.

1950 to 383 days in 1960 (Figure 5). Much of the increase in efficiency of labor could be attributed to the use of more and improved machinery. As inputs in machinery increased, labor efficiency was increased.² During the years 1957 through 1960 annual machinery inputs increased from \$4,582 to \$5,389, while labor efficiency increased from 285 productive man-work days per man equivalent to 383 (Figure 5).

Changes in capital investment. Total capital investment on this case farm increased 44.8 per cent during the thirteen-year period. Real estate capital increased 28.3 per cent while non-real estate capital increased 86.3 per cent. The increase in real estate capital resulted from a \$2,700 increase in values of buildings and a \$10,000 increase in land value as a result of purchase of 110 acres of additional land in 1954. Land values were held constant other than for purchase of land. Non-real estate capital averaged slightly over one-third of total capital and ranged from about 28 to 40 per cent of total capital. Much of the increase in non-real estate capital was due to increase in livestock and machinery investments. Between 1948 and 1960 machinery investment increased 145 per cent, livestock investment 64 per cent, and feed and seed investment about 33 per cent. Feed and seed inventory values rose and fell with crop yields (Figure 6).

Rate of capital turnover is frequently used as an index of success. Capital turnover has been relatively high on this farm,

²Machinery inputs include machinery operating costs plus ten per cent depreciation on machinery investment.

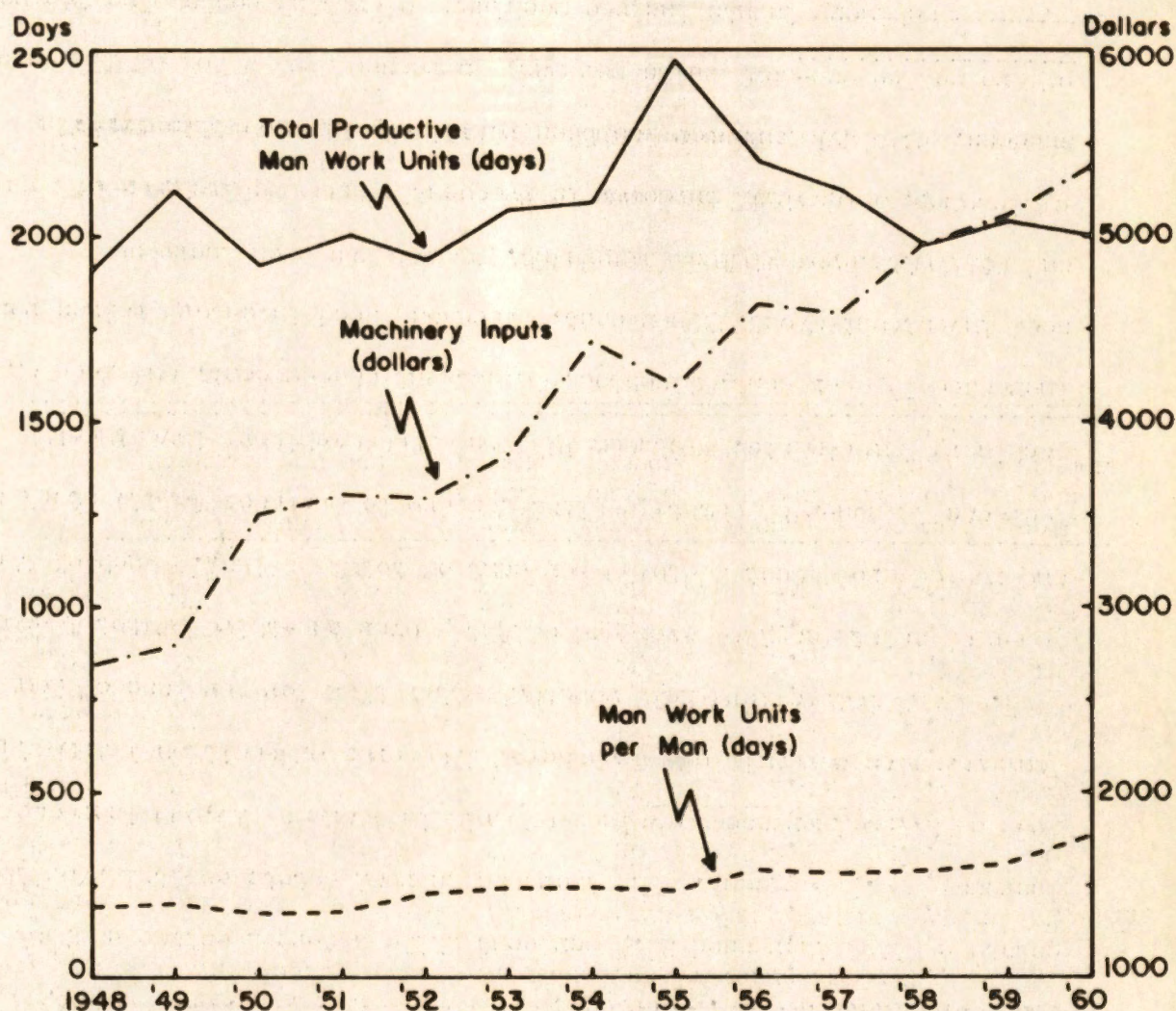


FIGURE 5

TOTAL PRODUCTIVE MAN-WORK UNITS, LABOR EFFICIENCY
AND MACHINERY INPUTS, CASE FARM 1

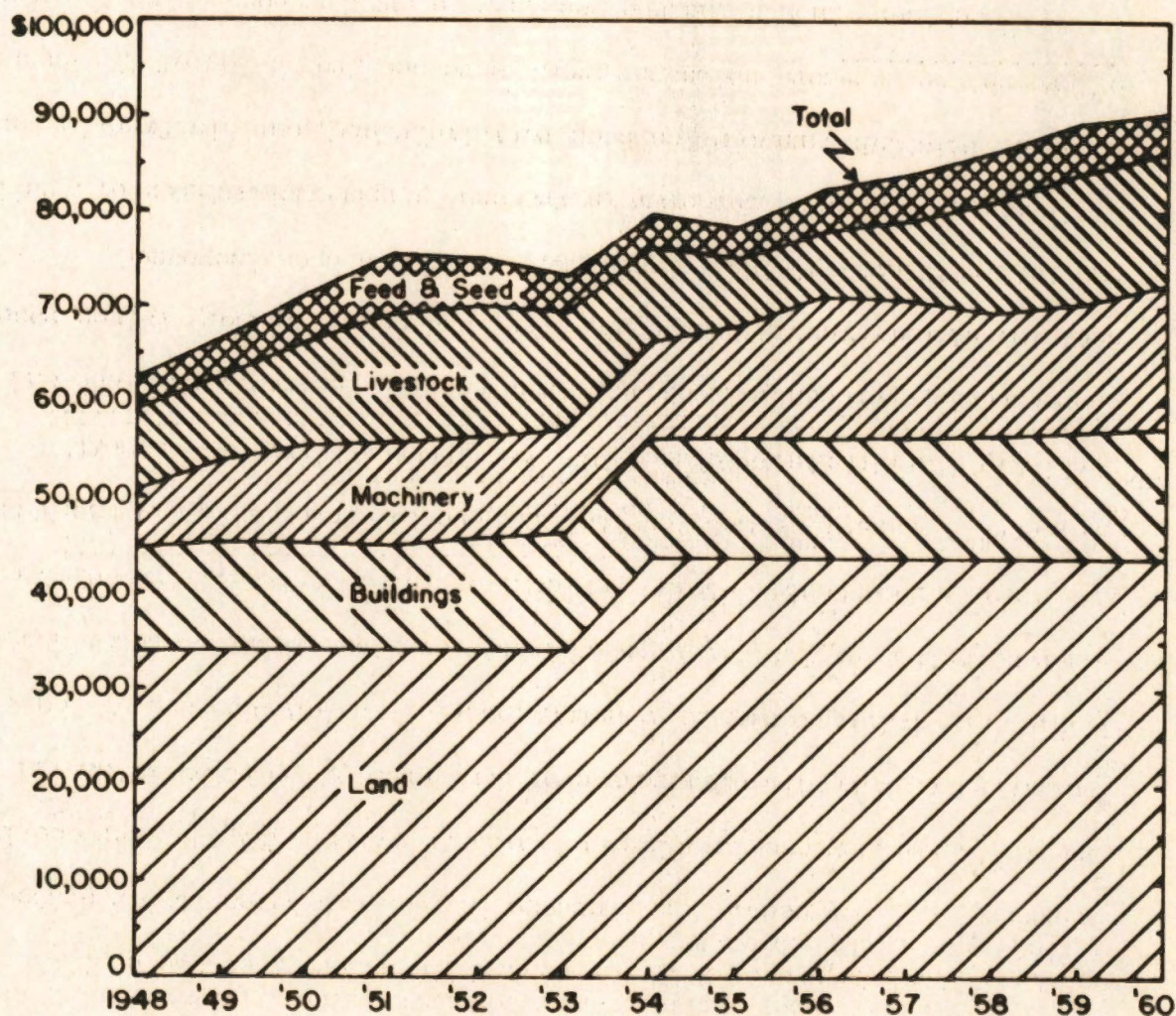


FIGURE 6

CAPITAL INVENTORY VALUES, CASE FARM 1

ranging from 27.95 per cent in 1952 to 58.05 in 1950, averaging 45.08 per cent for the entire thirteen-year period.³ This measure of success is associated with outputs, as reflected by crop and livestock sales. Periods of low capital turnover, 1952 and 1954, were extreme drought years and crop yields were low. These were the only years in which capital turnover fell below 40 per cent. The capital turnover and per cent non-real estate capital was of total investment are shown by years in Figure 7.

Changes in income and expenses. There was a wide variation in gross as well as net farm income during the thirteen-year period.⁴ Gross farm receipts fluctuated from a low of \$21,020 in 1952 to \$45,077 in 1955. Average gross receipts for the entire period was \$35,811. Farm receipts were a function of yields and volume of sales. Prices remained relatively stable during these years while receipts rose and fell with crop yields, as indicated in Figure 8. Crop sales were the predominant source of cash income, ranging from 91.9 per cent of the

³Capital turnover is determined by dividing the gross income for the farm in a given year by the total capital investment. Capital turnover in agriculture for the United States averaged 29.6 per cent for the period 1948 through 1960. The method of determining capital turnover for case farms and for the United States differed slightly. United States gross income included home consumption of products, and did not include value of dwellings in capital inventory. Gross income on case study farms did not include values of home consumption of products while inventory values included the value of dwellings.

⁴"Net farm income" as used here and subsequently is defined as returns to operator labor, management, and capital.

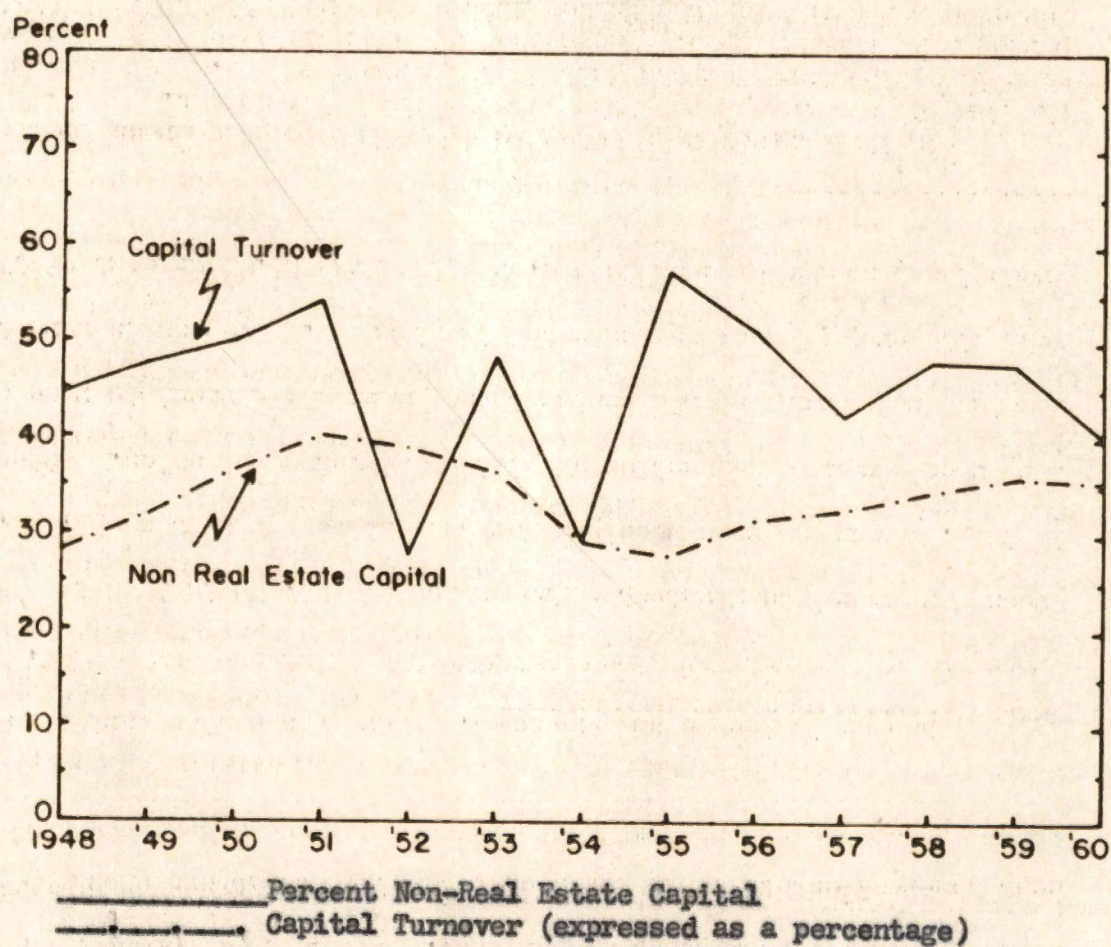


FIGURE 7

RELATIONSHIP BETWEEN PER CENT OF TOTAL INVESTMENT IN
NON-REAL ESTATE ASSETS AND CAPITAL TURNOVER,
CASE FARM 1

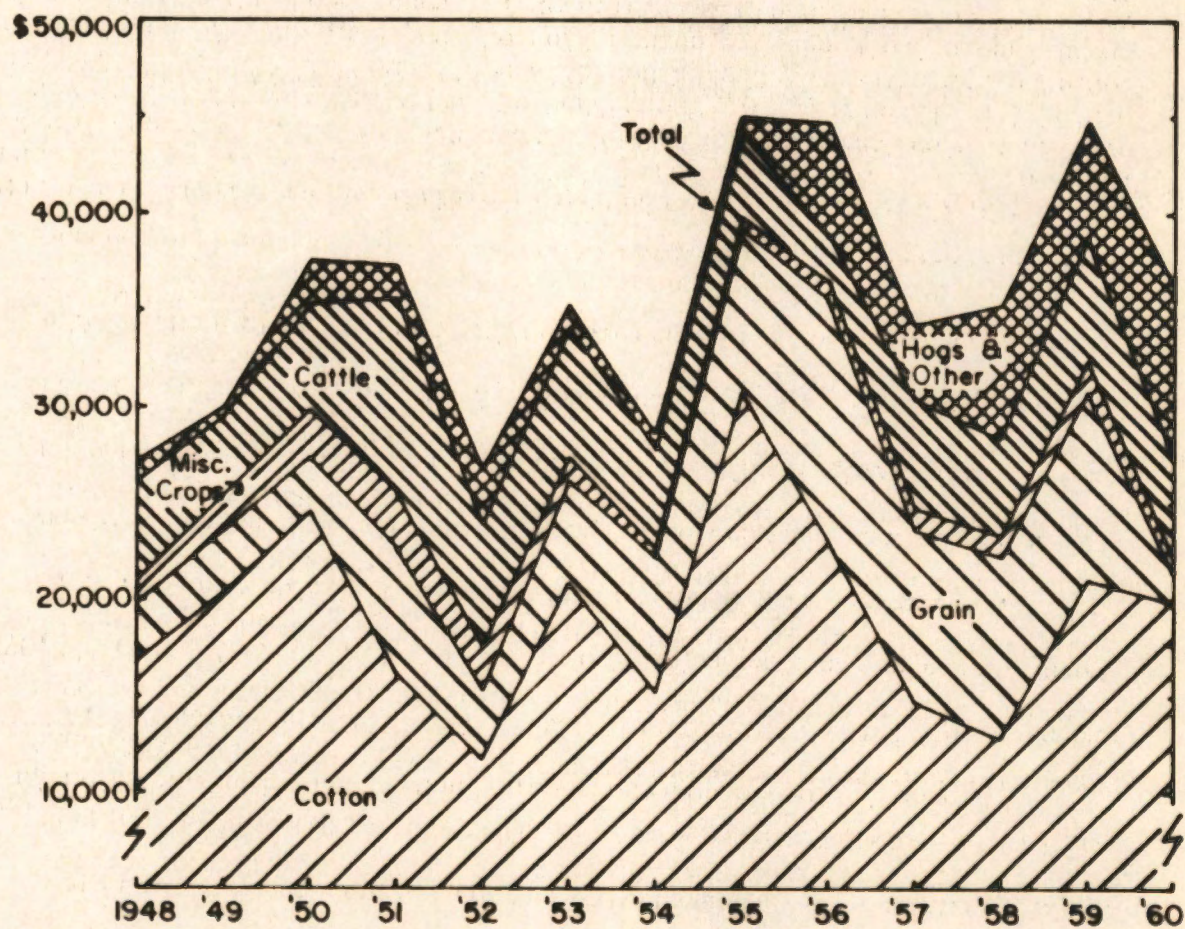


FIGURE 8

VARIATION IN CASH RECEIPTS BY SOURCES, CASE FARM 1

total cash receipts in 1956 to 60.9 per cent in 1960, averaging 76.2 for the period. The general trend was toward more grain and livestock sales as shown in Figure 8. Cash receipts for livestock ranged from a high of 38.4 per cent of total cash receipts in 1960 to a low of 8.1 per cent in 1956 and averaged 21.5 per cent for the entire period. The low receipts from livestock in 1956 were due to a small calf crop resulting from the brucellosis problem in the brood cow herd in 1955. Increased livestock receipts for the last four years were a result of the expanded hog program, which accounted for 24.2 per cent of total cash receipts in 1960.

The year to year variation in net farm income was greater than for either cash receipts or total operating expenses. Net farm income varied with crop yields and livestock production, changes in inventories of crops and livestock, prices paid for factors of production and quantities required, and prices received for farm products. The coefficient of variation in net farm income was 53 per cent while the coefficient of variation was 17 per cent for total cash receipts, 16 per cent for operating expense, and 62 1/2 per cent for changes in feed, seed, and livestock inventories (Table V). The extremely high variability in these categories of inventory resulted in the relatively high variability in net farm income.

All expenses except labor increased during the period with considerable fluctuation from year to year. Fertilizer and seed cost, with fertilizers accounting for a large majority of this expense, increased more than other items. The increase in fertilizer and seed expense

TABLE V

AVERAGE INCOMES, EXPENSES, AND VARIATIONS FROM THE AVERAGE,
CASE FARM 1, 1948-60

Item	Average	Standard deviation	Coefficient of variation
Total cash receipts	\$35,268	\$5,983	17
Increased feed, seed, and livestock inventory	550	3,430	624
Total operating expense ^a	25,539	3,987	16
Net farm income	10,279	5,451	53

^aIncludes cash operating expenses plus 10 per cent depreciation on machinery and 5 per cent depreciation on buildings.

amounted to 151 per cent between 1948 and 1960. A major increase in expenses for machinery inputs was reflected in expense accounts. This was almost a steady increase with most years showing an increase over the previous year. Total increase in annual machinery expense amounted to 96 per cent for the thirteen-year period. The distribution of farm operating expenses is shown in Figure 9.

Summary of adjustments on Case Farm 1. The farm organization of this case farm was developed around the high value crops, primarily cotton and wheat. Acreage of these crops was controlled through acreage allotments for most years covered by the study and the relatively large acreage was due to past history on this particular farm. Changes in land use were based to a large extent on changes in acreage allotments. Reduced

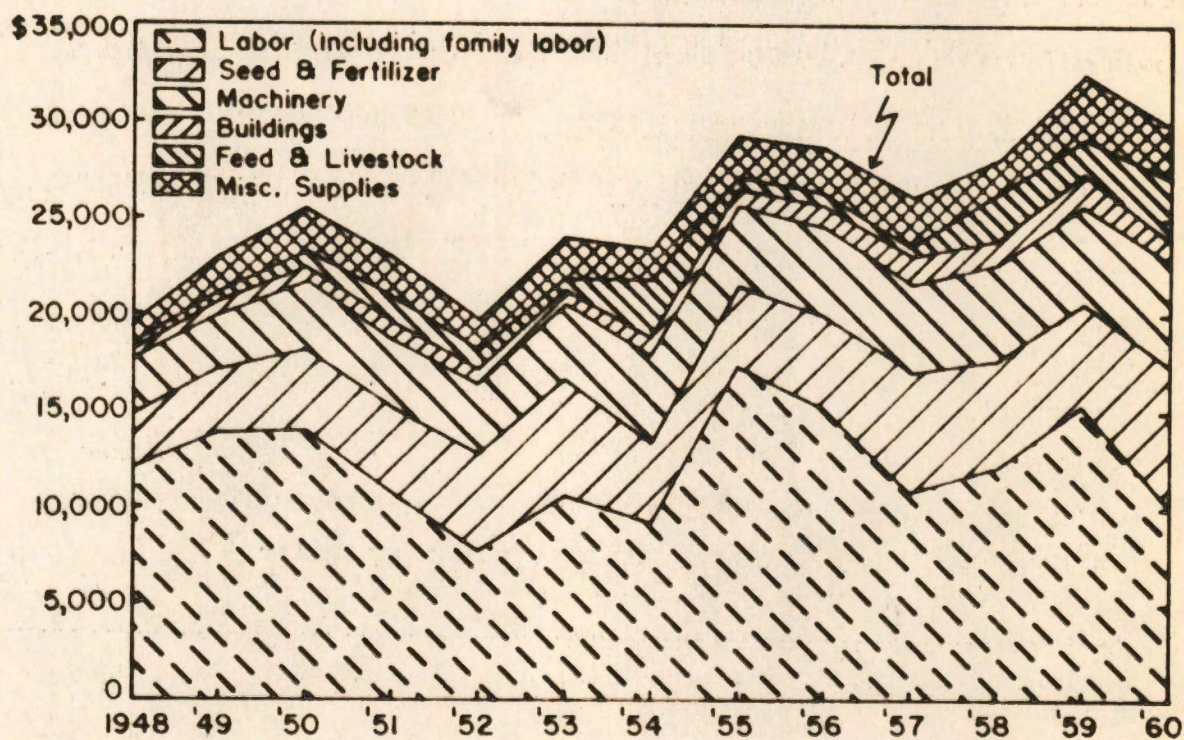


FIGURE 9

VARIATION IN OPERATING EXPENSES BY SOURCES, CASE FARM 1

acres of allotted crops brought about a need for other sources of income from available land and other resources. These land use adjustments were primarily to support an increased livestock program. Land devoted to corn production was increased to some extent with reduced cotton acreages, and also replaced acres being devoted to lespedeza and silage. Another significant change was in land devoted to improved pasture and alfalfa. All of these adjustments were associated with the changes in the livestock enterprises. Open acres operated increased 25 per cent, which accounts for some of the higher allotment of government controlled crops and some increased acres devoted to other uses.

The addition of hogs to the farm program provided better utilization of labor through better distribution over the year. It provided a market for the additional grain produced and made productive use of land and other resources not needed on a full-time basis in other enterprises. The swine program fitted well into the existing farm organization as an additional enterprise for more efficient use of resources. The low production per unit of brood stock in the hog enterprise, as indicated by records for the years up until 1957, illustrates the importance of gaining knowledge about new enterprises or practices. As production per unit and size of this enterprise increased, hogs became second only to cotton as a source of income.

Capital accumulation was associated with the increased use of machinery and the increased livestock program. Investment in machinery increased 145 per cent and livestock increased 64 per cent while total capital investment increased 45 per cent. The increased machinery

inputs were directly associated with increased labor efficiency and lower labor costs per unit of output. This partially off-set the increased prices of inputs and the decreasing prices of products.

Increased yields were noted for most crops and were especially important in production of cotton on a decreased acreage. The increased yields of grain, along with increased acres devoted to both corn and wheat, resulted in a substantial increase in grain supply both as cash grain and feed for livestock. Increased use of plant nutrients, improvement in ratios of nutrients used, and improved varieties were largely responsible for increased yields.

Increased cash receipts per acre were possibly due to higher yields and the addition of hogs to the farm organization, with little or no change in labor used. But these improvements were off-set in terms of total cash receipts and net income because of reduced cotton acres and increased expenses. Expenses, as a per cent of cash receipts, increased from an average of 69 per cent for the first six years to 74 per cent for the last six years, while expenses increased 30 per cent and cash receipts increased only 21 per cent. The adjustments in labor and land use and increasing inventory values of livestock and stored feed were functions that contributed most to maintaining the relatively high net farm income during this period of increasing costs and decreasing product prices. Average net farm income for the first six years of the period was \$10,771 as compared to \$11,484 for the last six years. Average net farm income was 6.6 per cent higher for the last six years, while open acres in the farm was 25 per cent higher for the corresponding period. These facts tend to point up the importance of increased

outputs per unit in maintaining income during a period of increasing costs and decreasing prices. The decision to make resource-use adjustments was directed toward a better utilization of resources to replace reduced income opportunities from diverted cotton acres. This was accomplished through improved practices, resulting in higher returns from cotton and grain, and the addition of hogs to the farm organization. Cotton utilized an average of 26 per cent of open acres and accounted for 56 per cent of total cash receipts during the first six years of the period. This enterprise contributed an average of 49 per cent of total cash receipts, using only 18 per cent of open acres during the last six years. Grain amounted to 12 per cent of the cash income in the first six-year period and 24 per cent of cash income in the last six-year period. Hogs accounted for 1 per cent of the cash income in the 1948-53 period and 9 per cent of the cash income in the 1955-60 period. In 1960 sale of hogs made up 24 per cent of the cash income. These facts are significant in that resources used in cotton production maintained their relatively high income position while other resources were adjusted to make greater contributions to income through increased grain and hog production.

IV. ANALYSIS OF CASE FARM 2

General description. The second case farm to be studied is a 118-acre farm located in the Limestone Valley Area of Limestone County, Alabama. The soils are primarily of the Decatur and Cumberland series and range in relief from almost level to rolling. All open land on this farm is terraced to prevent erosion. The farm was purchased in 1940 through the Bankhead-Jones Tenant Purchase program. Acreage has remained

constant throughout the period with the exception of five acres being cleared for pasture and the renting of a small acreage during certain years for additional grain production. Dairying was the major farm enterprise until 1960 when the operator shifted from dairying to a beef cow and calf herd.

In 1948 the family consisted of the operator, his wife, and four children. All members of the family have been very active in agricultural programs of the county. By 1956, all the children except one son had left the farm and that year this son became a partner in the farm business. The operator, who is now sixty-one years of age, completed six years of school. The son, who is about twenty-five years of age, has completed three years of college work and is attending night classes to complete work toward a B. S. degree.

The labor force has consisted of family labor, one hired man, and extra seasonal labor as needed. Hired labor was used largely in the crop and feed production programs, while the dairy operation was handled by family labor. In the latter part of the period the son took over a larger share of the management, with his father working only part-time.

Changes in land use. The land use program of this farm was oriented primarily around the dairy enterprise. The production of forage crops and the use of land for this purpose became more important as the dairy enterprise was intensified in the latter part of the 1948-60 period.

In the early years of this period corn and cotton were being produced on a limited scale, and grain sorghum was being grown in rotation with winter grazing crops. After the first four years of this

period these crops were discontinued, with the exception of corn produced on rented land in 1958. These crops were replaced by improved pasture, small grain for both grain and grazing, and temporary summer grazing crops. Alfalfa became increasingly important in the feed production program during the latter years of the period. Seresia was used as a hay and grazing crop for several years but was discontinued in 1957. Lespedeza was used as a summer grazing crop for a few years, after which millet was used for this purpose. Acreages devoted to various crop uses are shown as averages for three periods of three years each in Table VI. Frequent changes noted in the land-use program were directed toward higher value forage production and a better balance in the grazing program. Unsuccessful attempts to get stands of alfalfa during the period 1953 to 1955 were a result of extreme fall droughts and poor quality seed. Increased alfalfa and improved pasture acreage, and the addition of millet in latter years, enabled the operator to increase the cattle-carrying capacity of available land resources.

Changes in crop yields. Harvested crops were of lesser importance in the last few years of the period of this study. More emphasis was placed on grazing with most of the concentrate feed being purchased. Actual yields of forage crops were rather difficult to measure accurately because, in many cases, the crop was utilized both by grazing and harvesting in the same season. Alfalfa, which was not grazed in the early years of the study, produced an average of three tons of hay per acre, whereas alfalfa which was grazed part of the season during the last three years produced an average of only .9 ton per acre. Cotton yields averaged 445

TABLE VI
LAND USE ON CASE FARM 2, AVERAGE FOR THREE PERIODS
OF THREE YEARS EACH

Land use	1946-50 Acres	1951-55 Acres	1956-60 Acres
Cotton	7	0	0
Corn	8	0	4
Grain sorghum	33	0	0
Oats	4	7	5
Wheat	5	18	0
Alfalfa	6	0	25
Sericea	10	11	0
Improved pasture	20	32	53
Winter legumes grass mixture	63	66	29
Millet	0	0	14
Truck crops	1	1	1
Lespedeza	0	7	0
Cropland used ^a	157	142	131
Open land ^b	100	115	115

^aAcres of cropland used exceeds total open acres due to double cropping.

^bAcres of open land was increased in 1953 and again in 1958 by renting additional land.

pounds of lint cotton per acre, ranging from 389 to 477 during the first four years of the period. Corn yields ranged from 38 bushels per acre to 83 bushels, averaging 64 bushels, and grain sorghum averaged 28 bushels per acre, ranging from 25 to 50 bushels. These crops were grown on this farm only during the first four years of the period of this study. Twelve acres of rented land produced only 20 bushels of corn per acre in 1958. Oat yields, on acreage harvested for grain, ranged from 36 to 80 bushels per acre, averaging 58 bushels for the ten years it was grown. Wheat yields averaged 21 bushels per acre and ranged from 14 to 37 bushels over a nine-year period. Annual crop yields are shown in Table VII. The highly variable crop yields were primarily a result of unfavorable weather conditions. These fluctuations and uncertainties in production of crops were possibly the major factors involved in decisions to shift land uses to a complete forage production program.

Changes in commercial fertilization rates. The use of commercial fertilizers had a prominent part in increasing and maintaining production of feed and forage crops. Rates of fertilizer used were relatively high throughout the period, ranging from 100 pounds of total nutrients to 201 pounds per open acre and averaging 123 pounds. The relatively high rates of nitrogen used during the years 1952 through 1958 were related largely to the winter grain and grazing program.

More drastic changes were made in ratios of plant nutrients used. The high phosphate, low potash ratios of early years were shifted to a more even application of these nutrients during the latter part of this thirteen-year period. In the 1948-50 period the average phosphate-

TABLE VII
ANNUAL CROP YIELDS FOR HARVESTED CROPS, CASE FARM 2

Year	Crop							
	Cotton lbs. lint	Corn bu.	Grain sorghum bu.	Oats bu.	Wheat bu.	Barley bu.	Alfalfa tons	Sericea tons
1948	459	75	25	40	37	25	3.0	2.0
1949	477	83	27	64	25	—	3.0	1.0
1950	457	70	25	35	14	—	3.0	1.5
1951	389	38	50	—	34	—	3.0	1.5
1952	—	—	—	60	17	27	—	1.5
1953	—	—	—	66	16	45	—	0.8
1954	—	—	—	67	32	30	—	—
1955	—	—	—	65	19	—	—	1.0
1956	—	—	—	80	—	—	—	1.0
1957	—	—	—	40	21	—	—	1.6
1958	—	20	—	50	—	—	2.6	—
1959	—	—	—	—	—	—	0.7	—
1960	—	—	—	—	—	—	1.0	—

potash ratio of the fertilizer used was 12.7 to 1 while in the 1958-60 period the corresponding ratio was .84 to 1. The shift toward a higher use of potash relative to phosphate began in 1954 and continued throughout the remainder of the period.

As the land-use program shifted from small grain and grasses to more legumes and mixtures of grasses and legumes for pastures, lime applications were increased considerably. The larger applications of lime were made as both alfalfa and improved pasture acreages were being increased.

The annual application of plant nutrients and lime are shown on an open acre basis in Table VIII.

Changes in the livestock program. The livestock program was predominantly dairying throughout the thirteen-year period, with hogs and poultry kept only for family food supply. Numbers of dairy cows remained fairly constant from 1948-1955. In 1956 the son became a partner in the farm business and the dairy herd was increased from 28 to 34 cows. The herd was increased to 37 head in 1957 and to 41 in 1959. An average of 21 dairy cows was shown for 1960, but by the end of the year the livestock enterprise had been shifted from dairying to a beef cow and calf herd (Table IX).

Production per unit in the livestock program was relatively low during the first several years. This was reflected in terms of milk produced per cow and the per cent calf crop. The reduced milk production per cow during the period 1949-52 was a result of breeding problems or other management problems that reduced the calf crop to 60 per cent in

TABLE VIII

ANNUAL APPLICATION OF COMMERCIAL PLANT NUTRIENTS PER OPEN
ACRE, CASE FARM 2

Year	Pounds nitrogen	Pounds phosphate	Pounds potash	Total pounds nutrients	Pounds lime
1948	20	71	11	102	50
1949	14	87	4	105	—
1950	16	84	4	104	—
1951	14	83	13	110	29
1952	37	86	4	127	36
1953	34	79	—	113	—
1954	37	64	17	118	—
1955	39	69	16	124	160
1956	49	81	33	163	667
1957	76	65	60	201	268
1958	46	36	48	130	484
1959	35	34	35	104	—
1960	18	37	45	100	—

TABLE IX
LIVESTOCK PRODUCTION AND RELATED FACTORS, CASE FARM 2

Year	Number dairy cows	Pounds milk per cow	Per cent calf crop	Pounds milk sold per cow	Per cent milk sold	Number cattle sold
1948	27	5032	60	4761	95	21
1949	26	4701	100	4568	97	23
1950	26	4413	61	4174	95	22
1951	25	4907	100	4715	96	27
1952	26	4866	96	4769	98	16
1953	29	5500	100	5417	98	16
1954	27	5200	82	5131	99	35
1955	28	7288	115	7176	99	30
1956	34	7050	100	6784	96	27
1957	37	7727	100	7472	97	24
1958	37	6864	100	6619	96	49
1959	41	6821	100	6364	94	50
1960	21	6866	100	6125	89	78

1948 and 61 per cent in 1950. Improved production per cow is noted for the period 1953-60. The dairy herd was composed of Jersey and Holstein cows. Production ranged from 4,413 to 5,500 pounds per cow during the first six years and from 6,821 to 7,727 for the last six years (Table IX).

The per cent of milk marketed was an important factor in obtaining maximum income from the dairy enterprise. This is reflected in both the amount of Class I milk that is sold during spring months and the amount of milk rejected because of spoilage or off-flavor. Prices received for dairy products indicate a high per cent of milk sold as Class I and a very low per cent rejected for various reasons. Per cent of milk sold ranged from 94 to 99 for all years except 1960. The decrease to 89 per cent for the year 1960 was possibly a result of discontinuing the milk market prior to shifting the enterprise to beef cattle.

Change in labor force and labor efficiency. The family labor force began decreasing in 1948 and by 1959 three of the children had left the farm, leaving the operator, his wife, and one son. This son was not employed on the farm in 1951 and was in the armed service during 1954 and 1955. Upon returning to the farm, the son became a partner in the farm business in 1956.

A tenant was added to the labor force in 1949 and remained on the farm throughout the period. However, this tenant was not employed full time in the farm operation during 1951 and 1960. Some extra seasonal labor was used during the early years of the study but this type of labor was not needed after discontinuing cotton from the program. The labor

force declined from 1948 to 1954 as the children left the farm, increased for the period 1955 to 1959 with added family labor supplied by the son as a partner in the farm business. The labor force decreased in 1960, when hired labor was no longer needed in the farm program.

Volume of business, in terms of productive man-work units, ranged from 460 to 643 for all years except 1960 when beef cattle were substituted for dairy cattle, dropping the productive work units to 392.

Labor efficiency in terms of productive work units per man equivalent fluctuated to some extent during the period but increased considerably during the last four years. This increase in labor efficiency was partly due to the increased use of machinery, as indicated by annual machinery inputs. These ranged from \$1,250 in 1948 to \$3,186 in 1958. Although the relationship was not obvious in every year, in general, labor efficiency increased with increased use of machinery (Figure 10).

Changes in capital investment. Total capital investment in the farm business almost doubled during the period of this study, increasing from \$22,847 in 1948 to \$42,855 in 1960. Changes were reflected in all categories of inventory, with the greatest change occurring in real estate capital, which increased 162 per cent. All of the increase in real estate capital was in buildings, which included remodeling of the original dwelling, a new house for the son, improvements on the tenant house, and additions to the milking barn. Land values were held constant for the entire period.

Values of livestock on the farm increased 94 per cent between 1948 and 1959. Investment in livestock actually decreased from 1959 to 1960 because of the change from dairying to beef cows.

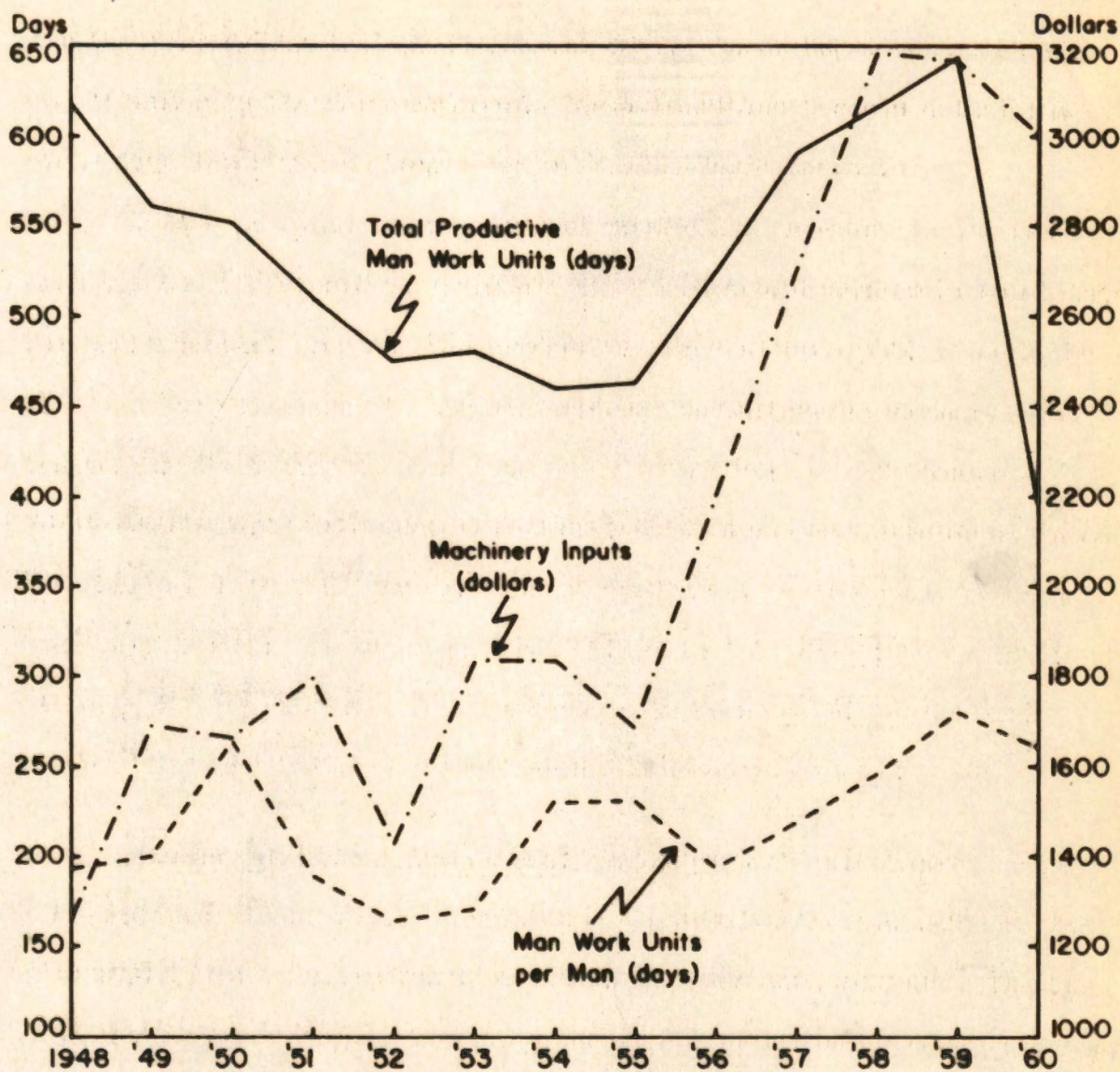


FIGURE 10

TOTAL PRODUCTIVE MAN-WORK UNITS, LABOR EFFICIENCY
AND MACHINERY INPUTS,
CASE FARM 2

Investments in machinery varied with years because of depreciation and the addition of new equipment. Total investment in machinery increased 40 per cent over the thirteen years with the largest increase being made after 1955. The decline in machinery values during 1953 to 1955 was possibly due to the low incomes of 1952 and 1954, resulting in less machinery replacements due to lack of capital.

Feed and seed inventories fluctuated with the years as a result of yields. The low period of 1952 through 1955 was a period of drought years and also a period during which alfalfa was not in the land-use program. This resulted in less stored feed as well as a lower-value roughage.

Capital investment in various farm assets is shown in Figure 11 by years.

Changes in income and expenses. From the beginning of this period the dairy program became increasingly important as a source of farm income. The per cent of cash revenue from this enterprise varied with the years, ranging from 55.7 per cent in 1948 to 94.7 per cent in 1959. The sale of dairy products and cattle from the dairy herd was the only source of cash income, other than miscellaneous items, during the last three years of the period. This specialization was brought about by a lack of additional land for expanding the dairy herd or other enterprises and the advantages of higher returns from resources available to the operator. Cotton, grain, and seed were sources of income in the first few years, accounting for 26.6 per cent of total cash sales in 1948. These enterprises declined in importance, with cotton being eliminated in

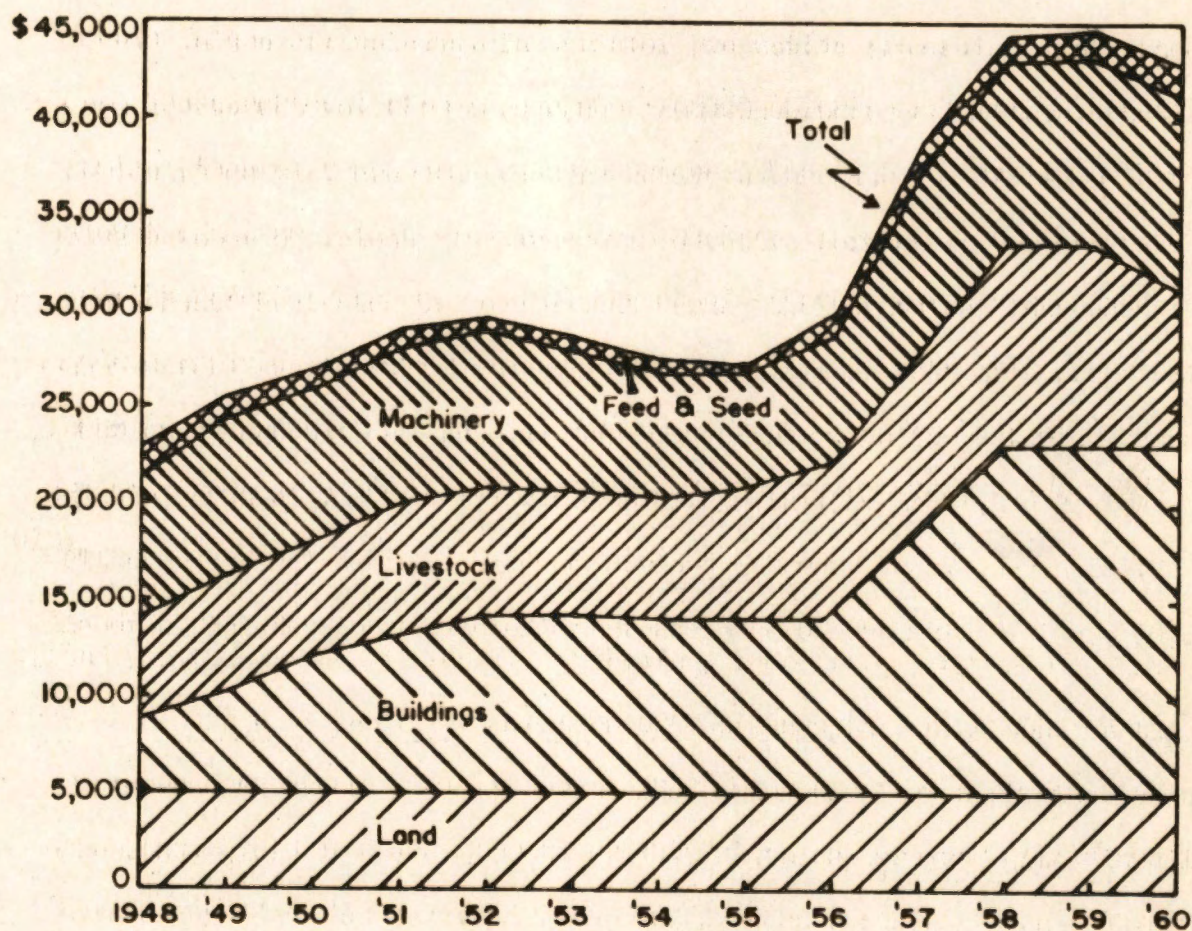


FIGURE 11

CAPITAL INVENTORY VALUES, CASE FARM 2

1951, seed crops in 1953, and cash grain in 1957. In 1960, with the shifting from dairy to beef, income from sale of cattle accounted for 55.5 per cent of the cash income with milk sales reduced to 39.6 per cent of the total (Figure 12). Cash receipts averaged \$13,427 for the period, ranging from \$9,377 in 1951 to \$20,431 in 1960.

The residual income expressed as net farm income varied rather widely with a low of \$1,268 in 1954 and a high of \$9,034 in 1957, averaging \$5,251 for the period. This measure of income was affected by the amount of total cash receipts, operating expenses, and the change of inventory values. Net farm income fluctuated more than did total cash receipts or operating expenses. Net farm income had a standard deviation of \$2,045 and a coefficient of variation of 39 per cent, while the coefficient of variation was 27 per cent for cash receipts and 30 per cent for operating expenses during the thirteen-year period (Table X).

Capital turnover was relatively high for most years of the study, varying from 30 per cent in 1952 to 71.6 in 1948. The trend was usually in the same direction and/or in proportion to the amount of non-real estate capital (Figure 13). As non-real estate values, in proportion to total inventory, declined during the period 1948 to 1955, capital turnover was at a relatively lower rate than for the period 1956 to 1960. Capital turnover varied less during these latter years.

Operating expenses declined during the first four years, then began a steady increase, reaching a peak of \$12,223 in 1957 and were slightly below this high for the last three years. Expenses averaged \$8,265 for the thirteen years, with the smallest amount for expenditures being \$4,981

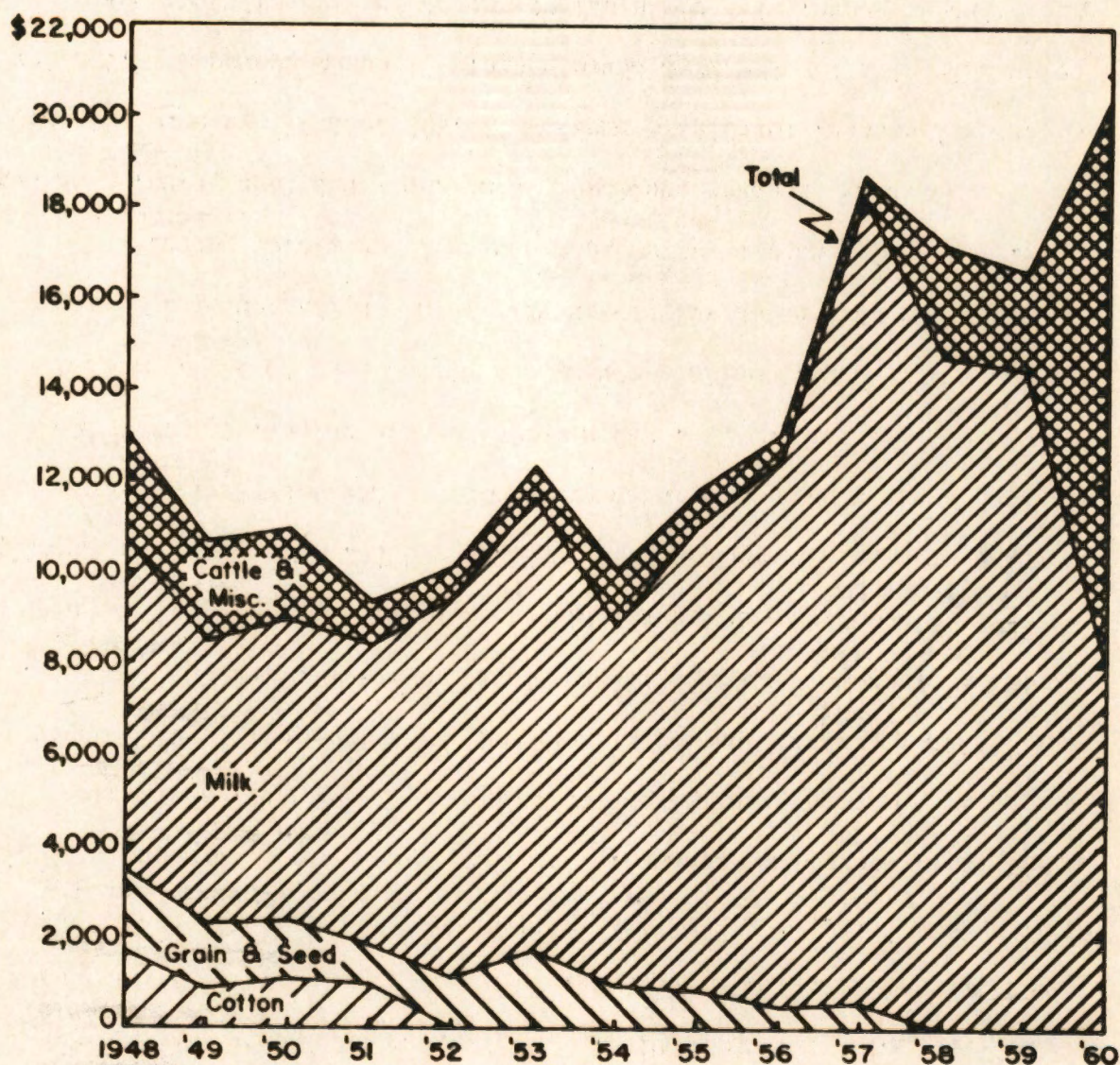


FIGURE 12

VARIATION IN CASH RECEIPTS BY SOURCES,
CASE FARM 2

TABLE X
AVERAGE INCOMES, EXPENSES, AND VARIATIONS FROM
THE AVERAGE, CASE FARM 2, 1948-60

Items	Average	Standard deviation	Coefficient of variation
Total cash receipts	\$13,427	\$3,633	27
Inventory change	89	2,152	2418
Total operating expense	8,265	2,459	30
Net farm income	5,251	2,045	39

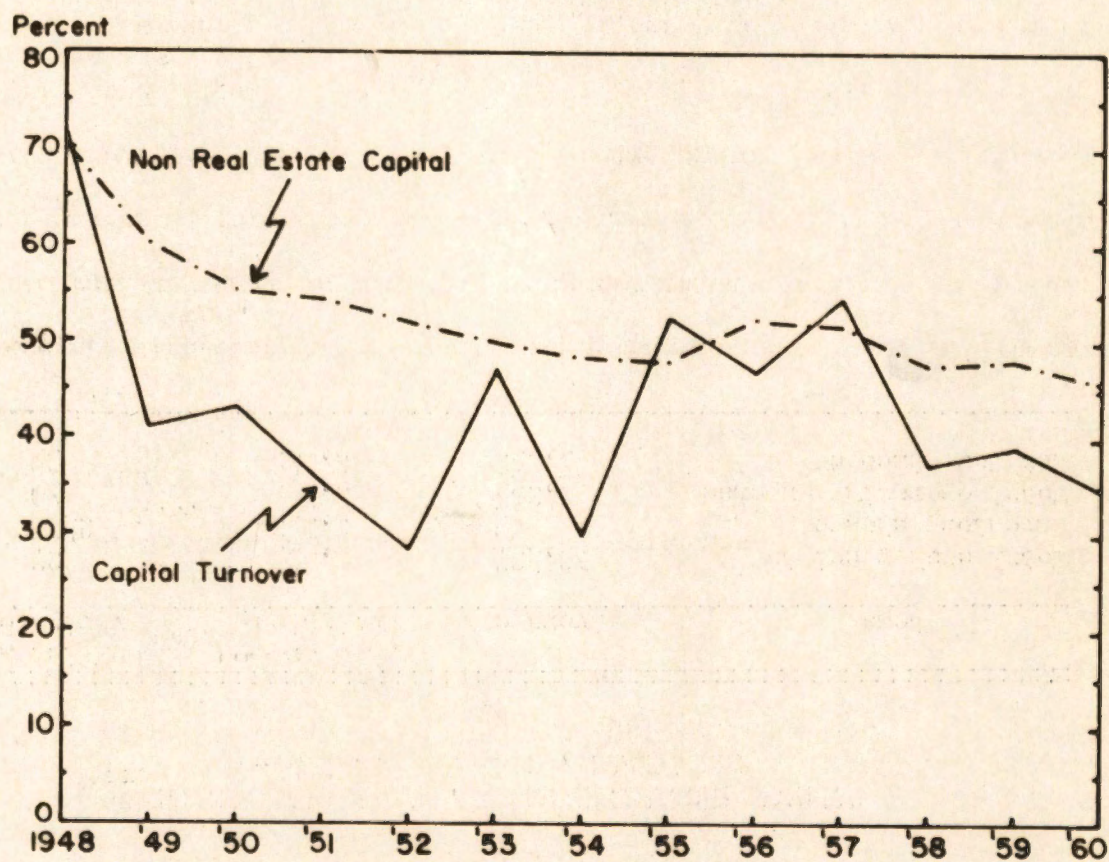


FIGURE 13

RELATIONSHIP BETWEEN PER CENT OF TOTAL INVESTMENT IN NON-REAL ESTATE ASSETS AND CAPITAL TURNOVER, CASE FARM 2

in 1951. During the first three years labor was the largest item of expenses, but after 1950 machinery inputs became predominant. Fertilizer expenses were relatively high throughout the period and were greater than labor expenditures for most years after 1950.

Livestock expenses varied considerably over time. This was brought about by increases in the dairy herd and attempts to improve milk production by replacing low-producing cows with better animals purchased as replacements. Miscellaneous expenses were greater as the dairy program became more intensified; most of these miscellaneous expenses were related to the dairy program. All categories of operating expenses are shown in Figure 14.

Summary of adjustments on Case Farm 2. The limited resources, especially land, were possibly the greatest factors influencing adjustments in the particular direction taken by this farm operator. As the dairy program developed in size and its contribution to income increased land use was diverted from cash crops to feed and forage crops. Acreage devoted to various forage crops was adjusted over the years with more land being used for alfalfa, millet, and improved pasture in later years. This trend toward greater specialization continued until all available land was directly involved in the dairy program. The decision to specialize in dairying was possibly influenced by opportunities afforded for increased income and greater efficiency in using resources through a more even distribution of requirements for land, labor, machinery, and capital. The increased machinery use resulted in less labor requirements or made labor more efficient in the farm business.

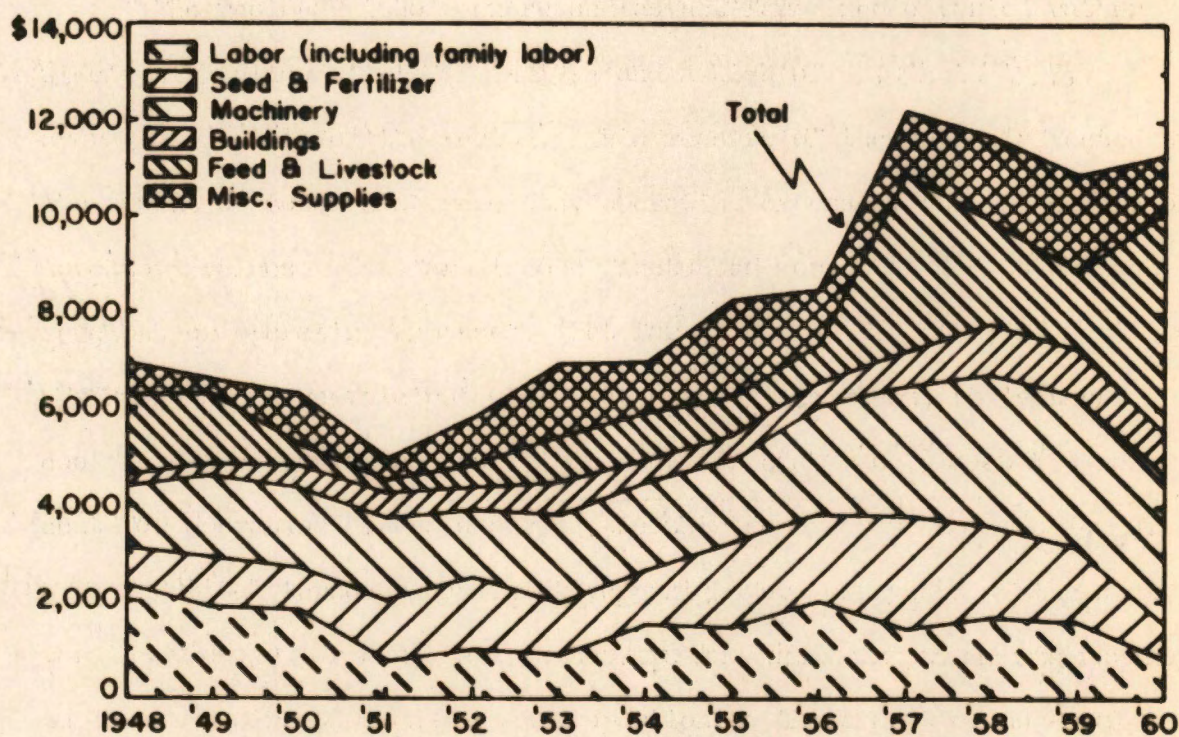


FIGURE 11.

VARIATIONS IN OPERATING EXPENSES BY SOURCES, CASE FARM 2

The adjustments in capital investment for non-real estate appear to have been primarily for the purpose of improving milk outputs. This was reflected in the increased values of livestock and machinery. Livestock values increased from \$5,317 in 1948 to \$10,335 in 1959, and machinery values increased from \$7,197 to \$9,613 for the corresponding period. Volume of milk production was increased for the last six years of the study by 69 per cent above the first six years. Production per cow was up 36 per cent and the average number of cows was up 25 per cent for the corresponding periods. These adjustments brought about increased pressures for resource uses in the dairy enterprise, resulting in specialization and more efficient utilization of these resources in terms of output per man and per cow. The value of milk sold was 47 per cent higher for the last six years than for the first six. Yet net farm income as a per cent of gross cash receipts was 46.6 per cent for the first six years and 36.7 per cent for the last six years. Net farm income, which averaged \$5,173 for the first six years and \$5,993 for the last six, was increased only 15.9 per cent. This relationship of net farm income to total cash receipts reflects the effects of increasing costs in this farm business. Milk prices were relatively stable throughout the period, averaging \$6.00 per hundred pounds for the first six years and \$5.77 for the last six, or a reduction of 3.8 per cent in price of milk for the latter years.

The income opportunities, managerial ability gained over several years' experience in dairying, and opportunities for more efficient use of resources were factors associated with adjustments made in farm enterprises and the concentration of resource uses in the dairy program.

The son's return to the farm brought about a need for increased investments in buildings and productive resources. An additional dwelling was constructed over a two-year period and the dairy herd was increased from 28 to 41 cows over a four-year period. This delay in increasing capital outlay was possibly an attempt to spread expenses over time and/or to acquire more capital for making these expansions. The expanded dairy herd increased feed requirements and resulted in the decision to utilize all the land in producing forage and grazing crops and to purchase the required concentrates.

In early 1960 the operator was notified by the milk processing firm that bulk handling operations would go into effect on July 1, 1960. This was a forced decision in which the operator had a few alternatives. He could make large investments in new buildings, milking, and storage facilities, he could divert milk sales to manufacturing markets at greatly reduced prices, or he could change to other enterprises for which resources were suited. Other alternatives were possible, but hardly rational, under existing conditions. The uncertainties of land tenure for the son, lack of additional acres for expansion of the dairy enterprise, age of the operator, and the market change to bulk handling of milk were all possible factors involved in making the decision to discontinue the dairy program. In addition, the son could complete work for a college degree within a few months and may have felt that income opportunities were greater in other employment, especially in view of the other heirs' interest in the father's farm, and a lack of a long-term lease agreement.

The alternative chosen was that of a beef cow and calf herd. This enterprise was adapted to the existing land use program and required the

labor of only one man, with some additional labor during certain seasons. The hired man was no longer needed and the son was free to spend more time on his college program.

CRIMES & CRIST

CHAPTER IV

ANALYSIS OF APPALACHIAN AREA CASE FARMS

This chapter will deal with the analysis of changes occurring on two case farms in the Appalachian Plateau Area of North Alabama over the thirteen-year period, 1948-60. The presentation of data and results will follow rather closely the form used in the previous chapter dealing with case farms located in the Limestone Valley Area.

I. ANALYSIS OF CASE FARM 3

General description. The third case farm to be analyzed is an 80-acre dairy farm located in Marshall County, Alabama. The operator, who is presently 61 years of age, completed high school and had a few years experience working on other dairy farms of Alabama and in New York State before entering this vocation as a farm operator in 1926.

The farm was being operated with a combination of poultry and dairy enterprises during the first several years of this study. Over time, the organization was changed to a specialized dairy farm, which utilized a major portion of the available resources. The dairy herd consisted of all purebred Jersey cows. Farm acreage owned remained constant throughout the period. This eighty acres, of which seventy-three acres are tillable, was supplemented with rented acreage six of the thirteen years. Forty acres of open land were rented and used in the production of grain and other harvested feed crops during the last three years of the thirteen-year period. A smaller acreage, ranging from three to nine acres, was rented in other years.

The farm is slightly larger than the average Appalachian Plateau farm and is predominantly Hartsells soils. This soil is typical of the area, responds well to good management, and is above average for the state in production. The farm ranges from rolling to hilly in relief and all land is terraced to prevent erosion.

Family members included the operator, his wife, and four children. All have been very active in educational activities of their community and county and have taken advantage of opportunities to gain knowledge of new methods and techniques relating to their particular farm and home situation. The four children, who have all completed college work leading to degrees, left the farm during the late 1940's and early 1950's.

The labor force was made up of the operator, his family, and hired labor during the first seven years of this thirteen-year period, with a hired man and the operator furnishing most of the labor during the last six years.

Changes in land use. Major adjustments in the land-use program have been toward the production of increased amounts and improved quality of forage for the dairy herd. Corn and small grain were produced ten of the thirteen years, silage nine of the thirteen years, and grain sorghum five years during this period. Alfalfa and winter grazing crops were major crops throughout the period, with acreage devoted to alfalfa ranging from seven to twenty-four acres and winter grazing from eight to thirty-nine acres. Improved pasture was increased from two to fourteen acres and millet, as a summer grazing crop, was added to the forage program in 1956, with acreage devoted to this crop ranging from eight to eighteen acres.

All tillable acres have been used rather intensely in the feed and grazing program. Double cropping was practiced when weather and soil conditions permitted. A common practice was to follow grain sorghum, millet, and silage with small grain or winter grazing and to rotate winter cover crops with corn or grain sorghum. Serecia, which was produced on the most hilly areas, utilized acreage ranging from two to eleven acres. It was over-seeded in the fall with fescue or rye grass during the period 1955-60.

Major adjustments in the land-use program were in the addition of summer grazing crops and some increased use of silage, corn, small grain, alfalfa, and winter cover crops (Table XI). These changes were primarily for the purpose of reducing feed costs and providing stored feed and grazing for the increased number of cows in the dairy herd.

Changes in crop yields. Harvested crop yields varied considerably over the years, having been affected by both weather conditions and uses made of crops grown. Corn yields averaged 44 bushels per acre for the ten years it was produced with yields ranging from 30 to 75 bushels per acre. Grain sorghum yields varied from 18 to 40 bushels per acre, averaging 30 bushels per acre for the five years produced. Oat yields ranged from 18 to 60 bushels, averaging 46 bushels per acre. Silage corn averaged 10.5 tons per acre, ranging from 8 to 15 tons. Alfalfa yields varied from 1 to 5 tons per acre. Crop yields for harvested crops are shown by years in table XII.

Changes in commercial fertilization rates. The rate of using plant nutrients varied considerably over the thirteen-year period,

TABLE XI
LAND USE ON CASE FARM 3, AVERAGES FOR 3 PERIODS
OF 3 YEARS EACH

Crops	1948-1950	1953-1955	1958-1960
	Acres	Acres	Acres
Corn	15	13	18
Grain sorghum	7	6	5
Silage	9	3	11
Small grain	10	13	14
Sericea	5	8	2
Millet	—	—	17
Winter cover	—	—	—
crops	34	33	39
Improved pasture	2	11	14
Alfalfa	10	12	15
Truck crops	1	1	1
Cropland used ^a	93	100	146
Open land ^b	73	74	114

^aAcres of cropland used exceeds total open acres due to double cropping.

^bAcreage of open land was increased in 1953 and again in 1958 by renting additional land.

TABLE XII
ANNUAL CROP YIELDS FOR HARVESTED CROPS,
CASE FARM 3

Year	Corn Bu.	Grain sorghum Bu.	Silage Tons	Small grain Bu.	Alfalfa Tons	Serecia Tons
1948	75	—	8	—	4.0	3.0
1949	40	40	12	—	3.0	2.0
1950	75	20	10	—	1.0	—
1951	—	—	—	—	4.0	—
1952	50	—	—	50	5.0	—
1953	60	18	—	50	4.2	—
1954	60	—	4	18	3.5	—
1955	30	26	—	44	3.0	—
1956	—	—	15	25	2.8	2.0
1957	—	—	14	—	3.0	—
1958	72	—	11	—	4.0	2.0
1959	31	—	8	40	2.5	—
1960	30	—	12	50	1.5	1.0

ranging from a low of 86 totaled pounds of nitrogen, phosphate, and potash per open acre in 1948 to 206 pounds in 1954. These major elements of plant nutrients were used in various ratios according to crops grown, with considerable differences in amounts of each used on a year-to-year basis. The amount of commercial nitrogen used ranged from none in 1951 to a high of 59 pounds per open acre in 1956. Phosphates were used at rates varying from 44 to 94 pounds per open acre. Application of potash ranged from 25 to 70 pounds per open acre. This high rate of applying plant nutrients was an attempt to maintain production on the limited acres, but was not always used in a ratio for most economical production since most crops grown in this area normally require mineral plant nutrients in equal proportions. The use of these nutrients was adjusted considerably in 1957 and a more equal ratio of phosphate and potash was used during each of the last four years. The low rate of nitrogen could possibly have been off-set by the use of winter legumes and mixtures of grasses and legumes that were grazed and turned under as green manure crops. Manure from the livestock enterprises also added nitrogen and small amounts of other elements to the fertilizer-use program. The contrast in ratios of commercial nutrients used can be seen in table XIII. Soil test recommendations were a more important basis for fertilizer use during the later part of the period than in earlier years.

Lime played a more important part in the fertilization program on this farm in the later years of this study. Lime was applied during nine of the last ten years with amounts ranging from 14 pounds per open acre in 1953 to 2737 pounds in 1960. During the period 1958-60 slightly over

TABLE XIII

ANNUAL APPLICATION OF COMMERCIAL PLANT NUTRIENTS PER OPEN ACRE,
CASE FARM 3

Year	Pounds nitrogen	Pounds phosphate	Pounds potash	Total nutrients	Pounds lime
1948	13	48	25	86	—
1949	31	56	61	148	—
1950	19	57	50	126	—
1951	—	89	60	149	274
1952	39	70	53	162	775
1953	38	93	27	158	14
1954	43	93	70	206	151
1955	49	93	36	178	645
1956	59	89	39	187	620
1957	54	52	55	161	—
1958	24	44	55	123	385
1959	54	44	43	141	949
1960	58	52	54	164	2737

two tons of lime were applied per open acre. This heavy use of lime is associated with the increased acreage devoted to grass legume mixtures in the grazing program and possibly to needs indicated by soil tests. The increased use of lime and the better balance in use of commercial fertilizer materials was not reflected in greatly improved yields of crops harvested. However, the increased dairy herd and higher production per cow does indicate an increased efficiency in the feed program.

Changes in the livestock program. Beginning with a farm organization of commercial egg production and dairying, this farm program was gradually changed to a specialized dairy operation. From 1956 to 1960 the average number of milk cows was increased from 25 to 34, while the average number of layers was reduced from 810 to 75. A major reason for this adjustment was possibly the decrease in the price received for eggs. Beginning in 1956, this price gradually declined from 59 cents per dozen to 32 cents. Another factor contributing to the decision to discontinue the poultry enterprise was the failing health of the operator's wife who normally handled the processing and marketing of poultry and eggs.

The dairy herd was increased 25 per cent during the last four years of the period. Number of cows in the herd averaged 25 for the entire period and 31 during the last four years. This decision to increase the dairy herd was possibly influenced by the need to offset loss of income from the poultry enterprise, to make more efficient use of hired labor and machinery on the farm, and to compensate for added expense of bulk milk handling facilities which were installed in 1956.

Efficiency in production of livestock and total production from livestock varied from year to year as a result of both weather conditions and management practices. Weather had considerable influence on the amount and quality of feed produced, while management practices influenced rate of output of livestock. The calf crop varied from 38 percent in 1948 to 100 per cent for several years during the period. Average milk production per cow fell to 3,128 pounds in 1953 and reached a high of 7,405 in 1960 (table XIV). The extreme low milk production in 1953 followed two years of relatively low reproduction rates of the dairy herd and a year of extreme drought which reduced the feed supply. The herd had been reduced to 15 cows, mostly heifers. Twenty-nine head of cows were sold in 1952. Milk production per cow improved considerably during the last four years of the period, increasing from an average of 5396 pounds for the first nine years to an average of 6,479 pounds per cow during the last four years. The average number of cows in the dairy herd was increased from 22 to 31 for the corresponding periods.

Average number of eggs produced per hen ranged from 125 in 1958 to 256 in 1951, averaging 193 for the entire period. During the last three years less emphasis was placed on egg production and it fell to an average of 133 eggs per hen.

Changes in the labor force and labor efficiency. The labor force on this farm was supplemented by seasonal hired labor nine out of the thirteen years. Labor on the farm was largely the operator and family labor until 1955 when a full-time hired man was employed. Total labor inputs, in terms of months of labor, depended to a large extent on the

TABLE XIV
LIVESTOCK PRODUCTION AND RELATED FACTORS,
CASE FARM 3

Year	Number dairy cows	Pounds milk per cow	Per cent calf crop	Per cent milk sold	Number cattle sold	Average number hens	Number eggs per hen	Average price milk per cwt.	Average price eggs per doz.	Average price poultry per head
1948	21	5796	38	96	7	585	143	6.93	.64	1.29
1949	21	5348	95	96	12	697	180	6.15	.60	2.14
1950	23	5891	100	97	15	572	213	6.63	.50	1.67
1951	25	6034	72	97	21	384	256	6.28	.64	2.54
1952	18	6232	89	96	35	495	104	6.99	.62	1.64
1953	15	3128	100	93	13	810	214	6.88	.58	2.10
1954	23	5278	74	97	5	833	187	6.01	.57	1.69
1955	26	5528	92	96	9	832	206	7.75	.58	1.40
1956	25	4962	88	98	28	810	169	6.24	.59	1.81
1957	29	5207	100	97	22	450	240	6.28	.52	.91
1958	30	6357	90	96	27	281	125	6.45	.46	.88
1959	30	6767	88	90	22	100	142	6.47	.36	.90
1960	34	7405	100	89	29	75	150	6.36	.32	

machinery and equipment available and the enterprises involved in the farm program. Labor inputs ranged from 50 man months in 1949 to 24 man months in 1959 and 1960. Operator and/or family labor made up from 50 to 75 per cent of the labor force throughout the thirteen-year period.

Labor and machinery inputs varied from year to year with a trend toward less labor and increased machinery use. Machinery expense accounted for 15.6 per cent of total operating expenses in 1948 and 23.0 per cent in 1960. Labor expense, including family labor other than operator's labor, accounted for 20.4 per cent of all operating expenses in 1948 and 13.7 per cent in 1960, ranging from 10.4 to 23.9 per cent.

Efficiency, in terms of productive man-work units per man, tended higher throughout the period (Figure 15). The labor force averaged three men and 151 productive man work units per man during the first six years. During the last six years an average of 2.3 men were employed with 221 productive man-work units per man. Volume of business, in terms of productive work units, amounted to an average of 460 and 511 for corresponding periods (Figure 15).

Changes in capital inventory. Total capital inventory values increased 65 per cent over this thirteen-year period with machinery values increasing 132 per cent, buildings 81 per cent, and livestock 31 per cent. These values fluctuated over time, but tended higher during most of the period (Figure 16). Land values were held constant and seed and feed values rose and fell with yields of stored crops produced on the farm.

Changes in building values over the period were a result of \$1,000 spent on improvements of the dwelling in 1954, \$2,000 for improvements of

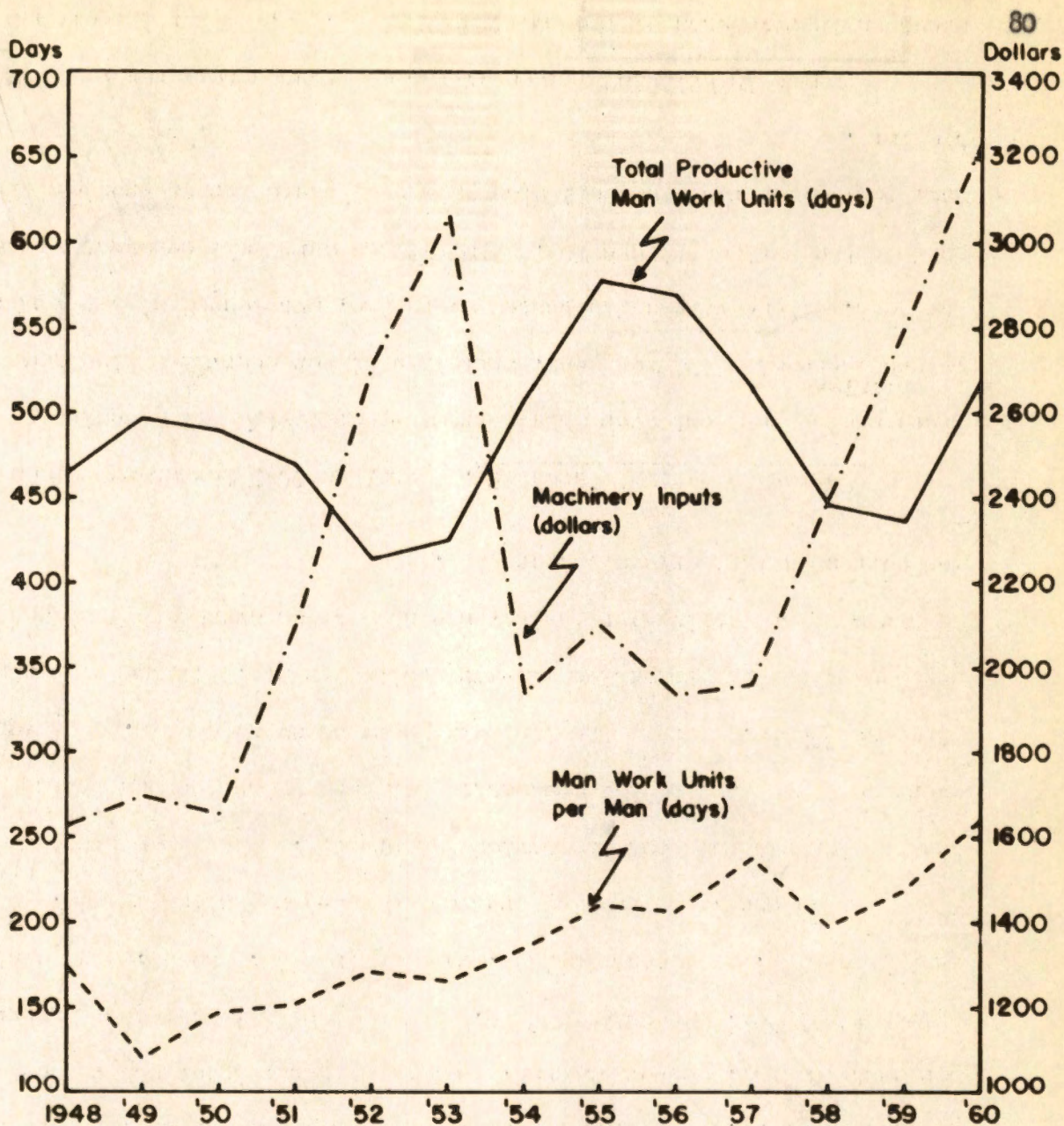


FIGURE 15

TOTAL PRODUCTIVE MAN-WORK UNITS, LABOR EFFICIENCY
AND MACHINERY INPUTS, CASE FARM 3

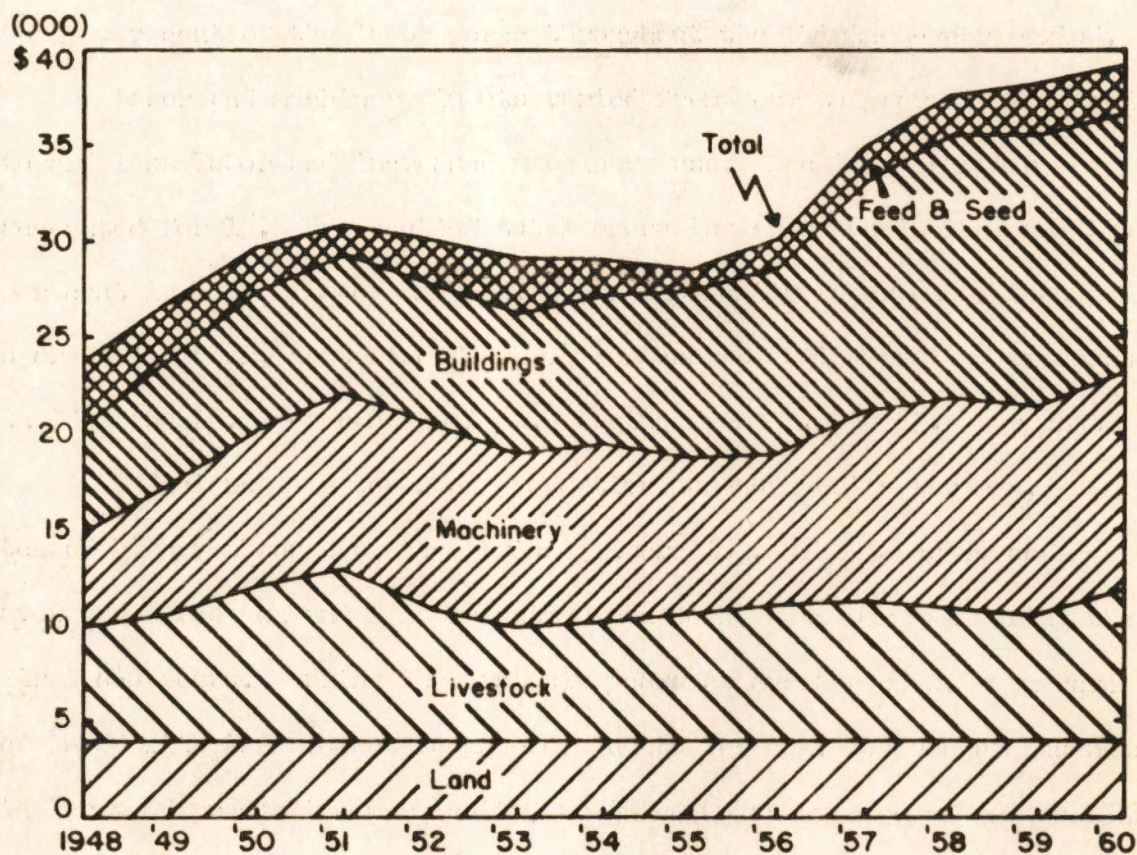


FIGURE 16

CAPITAL INVENTORY VALUES, CASE FARM 3

the tenant house in 1956, \$1,500 for the barn in 1957, and \$1,000 on the milk barn in 1958.

Changes in income and expenses. At the beginning of this period sources of income were fairly evenly divided between milk and poultry sales. An expansion of the poultry flock, along with decreased production of the dairy herd, made the poultry enterprise predominant during the period 1953 to 1955. A large per cent of the dairy herd was sold in 1952 with only a nucleus of heifers kept to restock the herd. This reduction in the dairy herd resulted in a reduced income from dairying of more than fifty per cent from 1952 to 1953. Part of the loss of income from reduction in size of dairy herd was off-set by a substantial increase in the size of the poultry flock in 1953 (Figure 17).

Net farm income was largely a function of farm output. Increases in outputs per unit and increased units of productive livestock accounted for major increases in net farm income during the period covered by this study. The sale of 29 head of mature dairy cows in 1952 made cattle an important source of income during that particular year. Cattle accounted for 38.6 per cent of all cash receipts in that year, but ranged between 2.2 and 12.4 per cent for all other years. Farm income was also influenced by changes in livestock and feed inventory values. As a result, fluctuation in net farm income was greater than for either operating expenses or cash farm receipts over the thirteen-year period. Net farm income had a coefficient of variation of 57 per cent over the thirteen-year period while the coefficients of variation for cash receipts and operating expenses were 15 per cent and 12 per cent, respectively. Inventory values of

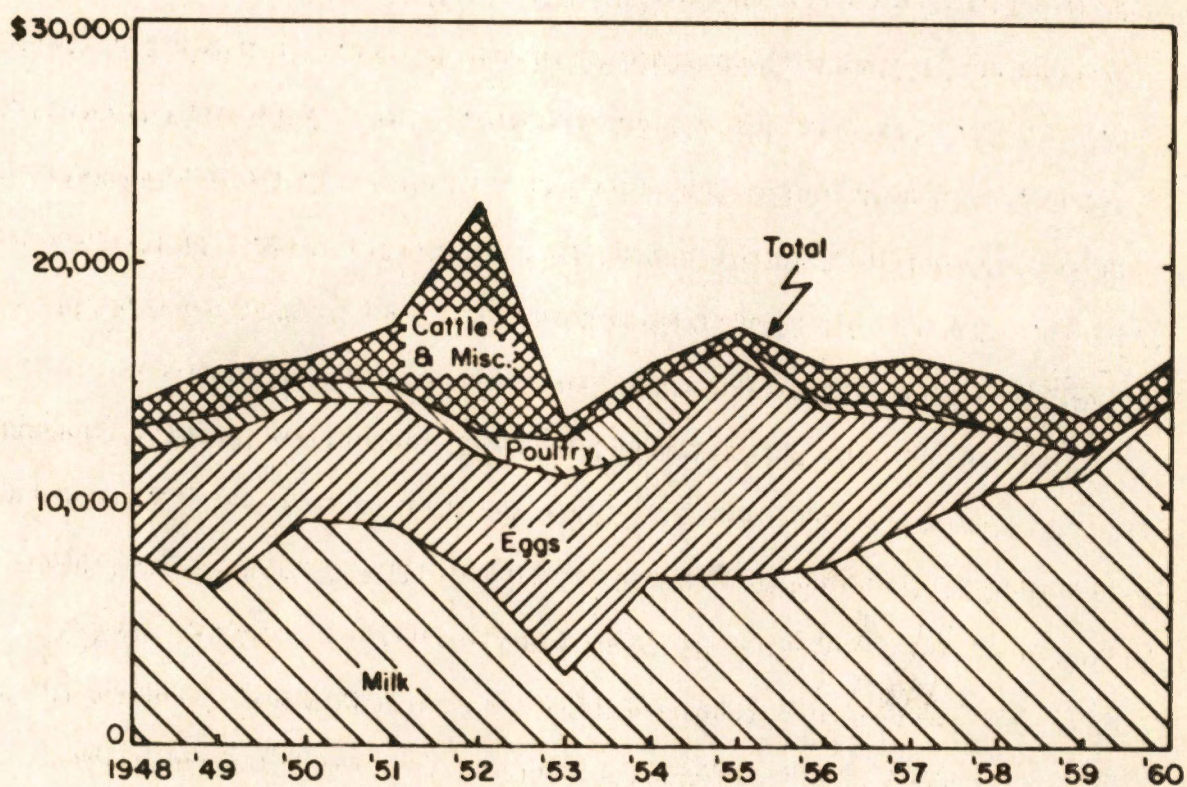


FIGURE 17

VARIATION IN CASH RECEIPTS BY SOURCES, CASE FARM 3

livestock and feed items fluctuated rather widely from year to year, having a coefficient of variation of 920 per cent (Table XV).

Capital turnover varied from year to year, averaging 58 per cent the first six years of the thirteen-year period and 41 per cent for the last six years and reaching a low of about 37 per cent in 1959 (Figure 18). The higher average capital turnover for the earlier years was possibly associated with the relatively high per cent of income from poultry during those years. As might be expected, a rather sharp drop in capital turnover is noted for years during which poultry contributed less to cash receipts.

Operating expenses for labor, as well as for livestock and feed, were reduced over time with labor expenses decreasing about 19 per cent and feed and livestock about 10 per cent for the last six years of the study, as compared with the first six years. The decrease in labor expense was partly due to increased machinery use while that for feed and livestock was almost entirely a result of discontinuing the poultry enterprise. Over-all expenses increased from \$10,422 to \$14,090 or 35 per cent between 1948 and 1960 (Figure 19). Total expenses averaged 10 per cent higher for the last six years than for the first six years of the thirteen-year period. The total operating expenses, as a percent of cash receipts, were 86 and 74 per cent, respectively for these two periods.

Summary of farm adjustments on Case Farm 3. The major change on this farm, over the thirteen-year period of this study, was in livestock enterprises, which had a direct relation to other changes, such as land use, labor, and machinery use. The opportunity to sell most of the dairy

TABLE XV

AVERAGE INCOMES, EXPENSES, AND VARIATIONS FROM THE AVERAGE,
CASE FARM 3, 1948-60

Item	Average	Standard deviation	Coefficient of variation
Cash receipts	\$16093	\$2338	15
Change in inventory	109	1033	920
Operating expense	12937	1513	12
Net farm income	3265	1862	57

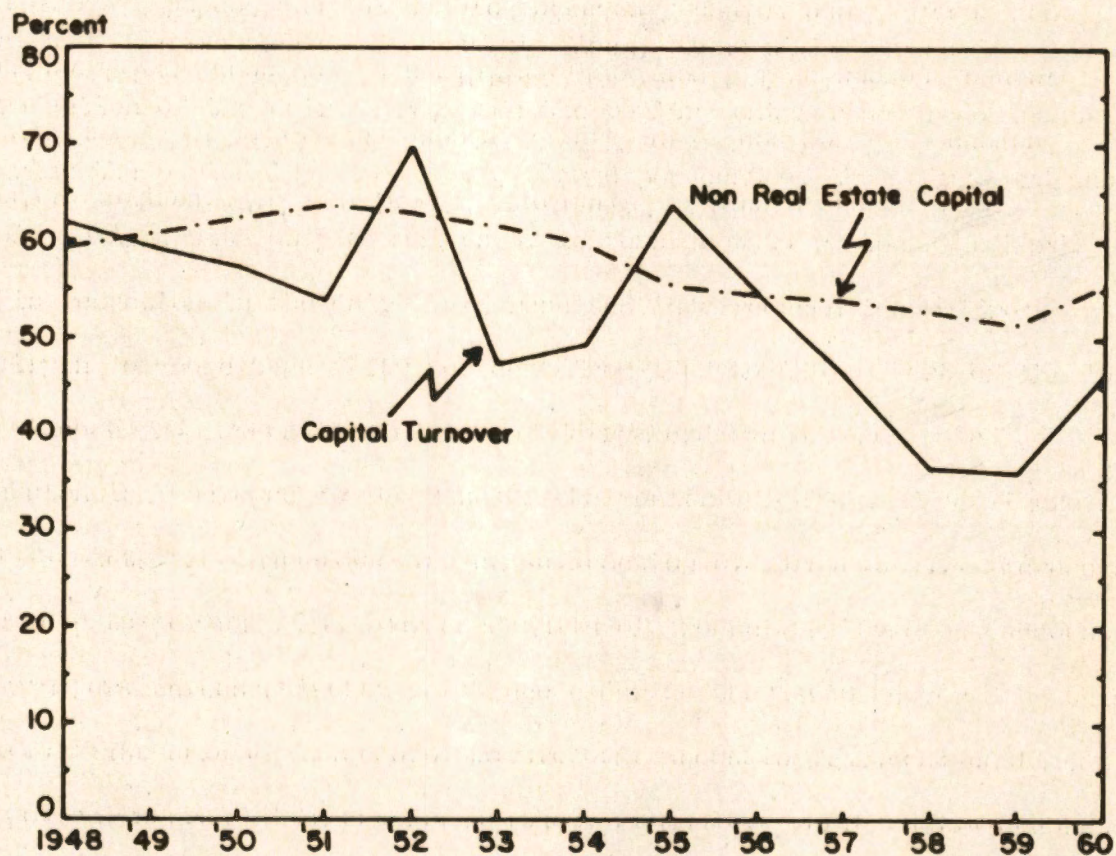


FIGURE 18

RELATIONSHIP BETWEEN PER CENT OF TOTAL INVESTMENT IN
NON-REAL ESTATE ASSETS AND CAPITAL TURNOVER,
CASE FARM 3

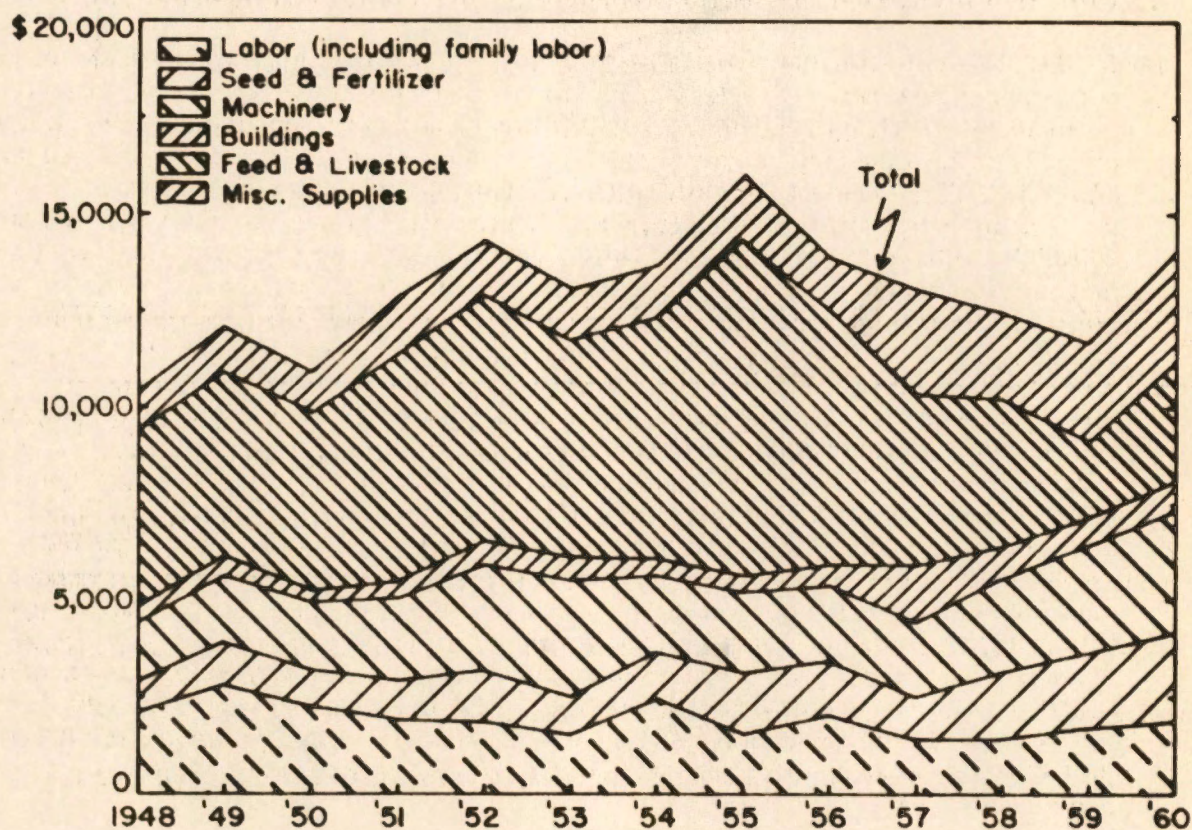


FIGURE 19

VARIATIONS IN OPERATING EXPENSES BY SOURCES,
CASE FARM 3

herd at relatively high prices and favorable market conditions for poultry and eggs were possibly major factors in the decision to reduce dairying and increase poultry in 1952. All the children had completed their education by 1956 and were no longer dependent on the farm for support. This reduced incentive, along with the age of the operator and the failing health of his wife, probably had considerable influence on the decision to concentrate resources in the dairy program during the later years. Prices received for both eggs and poultry were reduced substantially during the later years also, thus affording less opportunity for a good income from this enterprise. Poultry products were sold largely as dressed poultry and eggs, through regular customers. The operator's wife handled most of the marketing of these products and health conditions prevented her from doing this work during the last several years of the period.

Changes in the livestock program reduced the need for purchased feed, thus reducing expenses for this item. Increased uses of commercial fertilizer and the increased acres devoted to feed and forage were largely a result of the increased dairy herd and the concentration of resources in this enterprise to increase production and reduce costs.

The effects of increasing costs of production items and decreasing prices received by the farm operator are seen in the relationship between expenses and income. Cash receipts averaged about 5 per cent higher during the last six years of the period than for the first six years, whereas, operating expenses were 10 per cent higher for the comparative period. Net farm income averaged \$4,287 for the period 1948 through 1953

and \$2,703 for the 1955-1960 period or 37 per cent less for the latter years. Conditions of reducing margins of net profit resulted in efforts to increase farm outputs on both a unit and whole-farm basis. This is reflected in increased fertilizer use, increased acres devoted to feed crops, and the increased dairy herd. Fluctuations in outputs were largely associated with weather conditions, which influenced both yields and quality of feed crops, thus affecting livestock outputs. Management, also, influenced outputs in that the timeliness of carrying out certain practices, disease and insect control, and selection of replacement livestock were important factors in outputs per unit.

II. ANALYSIS OF CASE FARM 4

General description. The fourth case farm to be analyzed is located in the Appalachian Plateau Area of Marshall County, Alabama. This 75-acre farm of predominately Hartsells soils, is about average in size for farms of the area and has been operated primarily as a specialized poultry farm throughout the entire thirteen-year period of this study.

A major portion of the land has been used intensely in a grain, winter cover crop system. Terraces have been maintained on all open land as an erosion control measure. The farm consisted of only 39 acres of open land for the 1948-52 period. An additional 35 acres, of which 26 were tillable, were purchased in 1953. Some land was rented seven of the thirteen years.

The family consisted of the operator and his wife during the period 1948-52. A son, who returned from military service in 1953,

purchased the additional thirty-five acres of land and became a partner in the farm business. The operator, who is presently sixty-six years of age, completed thirteen years of school and the son, who is thirty-two years of age, completed sixteen years of school. The partners in this farm business have supplied most of the labor, using seasonal hired labor only to assist in the harvest of crops.

Management decisions have been made jointly by the two operators. Both have been active in many farm programs of the area and have taken advantage of opportunities to observe both agricultural research results and other farming operations. All major decisions are made after careful consideration of technical and economical aspects of the situation and counsel with specialists in the area of interest.

Changes in land use. The land use program of this farm has been centered largely around the poultry enterprise. Corn, oats, and grain sorghum were the important grain crops during most of the thirteen-year period. Grain sorghum production was discontinued in 1958 and oat production in 1959. High yields of corn as compared to other grain crops, along with the comparative advantage of corn in the feed program, were factors in the decision to increase corn acres and discontinue other grain crops. Winter grasses and winter legume crops were grown primarily as winter cover and green manure crops but were grazed during fall and winter months by the small herds of cows and hogs.

Serecia was added to the program to utilize rough land areas acquired in the purchase of additional land in 1953. In the latter part of the period, serecia production was discontinued and these acres were diverted to crop and pasture production uses.

Alfalfa acreage was increased from an average of three acres in 1948-50 period to six acres in the 1958-60 period and the average acres in improved pasture were increased from six to twelve for those corresponding periods (Table XVI).

Changes in crop yields. All crop yields were highly variable during this thirteen-year period. Corn yields ranged from 25 bushels per acre in 1952 to 108 bushels in 1958, averaging 76 bushels per acre for the entire period. Grain sorghum yields averaged 29 bushels per acre, ranging from a high of 54 bushels per acre in 1949 to a low of 10 bushels in 1957. Grain sorghum yields averaged 40 bushels per acre in the four-year period, 1948-51, but only 15 bushels per acre during the four years, 1953-57. This was likely a result of poor stands of grain sorghum which resulted from delaying planting of the crop until small grain was harvested. Insect damage also affected grain sorghum yields in the latter period. Low yields were probably the major reasons for discontinuing this particular grain crop.

Oat yields averaged 53 bushels per acre, varying from a low of 25 bushels to a high of 75 bushels. The relative advantages of corn, both in yields and feed value, were possible factors in the decision to discontinue oat production and to increase corn production.

Alfalfa yields averaged 2.7 tons per acre, ranging from one to five tons. Weather conditions and variations in the amount of grazing were major causes of the wide variations in harvested yields of alfalfa. Yields of the major crops grown on this farm by years are shown in Table XVII.

TABLE XVI

LAND USE ON CASE FARM 4, AVERAGES FOR 3 PERIODS OF
3 YEARS EACH

Crop	1948-50	1953-55	1958-60
	Acres	Acres	Acres
Cotton	0	1	0
Corn	10	29	47
Grain sorghum	9	9	0
Truck crops	2	2	1
Oats	6	10	3
Alfalfa	3	5	6
Sericea	0	3	2
Winter legume and grasses	23	43	57
Improved pasture	6	9	12
Cropland used ^a	59	111	128
Open land ^b	39	75	83
Land rented	0	10	19

^aAcres of cropland used exceeds total open acres due to double cropping.

^bAcres of open land varied because of additional acres rented. Thirty-six additional acres of land were purchased in 1953.

TABLE XVII
ANNUAL CROP YIELDS FOR HARVESTED CROPS, CASE FARM 4

Year	Corn bushels	Grain sorghum bushels	Oats bushels	Alfalfa tons
1948	90	30	75	5.0
1949	103	54	50	5.0
1950	98	40	42	2.0
1951	67	42	25	3.0
1952	25	—	54	2.0
1953	53	26	50	3.0
1954	35	13	42	2.0
1955	73	18	75	3.0
1956	68	12	57	1.0
1957	75	10	42	2.0
1958	108	—	—	3.0
1959	84	—	—	3.0
1960	92	—	—	3.0
Average	76	29	53	2.7

Changes in use of commercial fertilizer. The fertility program on this farm involved more than the use of commercial fertilizers; the use of poultry litter and green manure crops were also important in maintaining high yields in corn production.

Rates of commercial fertilizers used varied from year to year, but were relatively high for all years as compared to general agricultural experiment station recommendations for the crops grown. Total plant nutrients content of commercial fertilizers used ranged from 145 pounds per open acre to 235 pounds, averaging 192 pounds for the thirteen-year period. Average rates of the various plant nutrients were 61 pounds of nitrate, 80 pounds of phosphate, and 51 pounds of potash per open acre.

The ratio of phosphate and potash nutrients used varied from about four to one, respectively, in 1948, to about one to one in 1960. The use of phosphate varied from 55 to 111 pounds per open acre and potash from 19 to 72 pounds per open acre (Table XVIII). The use of commercial nitrogen was supplemented with poultry litter and green legume crops. It is rather difficult to measure the value of these in terms of nitrogen because of time of application of poultry litter and amount of growth of winter legume or green manure crops when turned under in the spring. However, both do add some nitrogen to the soil as well as improve water holding capacity and soil condition.

Lime used per open acre totaled about 4,640 pounds over the thirteen-year period with 1,267 pounds per open acre being applied in 1960.

TABLE XVIII

ANNUAL APPLICATION OF COMMERCIAL PLANT NUTRIENTS PER OPEN ACRE
CASE FARM 4

Year	Pounds nitrogen	Pounds phosphate	Pounds potash	Total pounds nutrients	Pounds lime
1948	50	83	19	152	—
1949	43	111	40	194	513
1950	51	120	39	210	—
1951	45	83	42	170	392
1952	64	103	58	225	769
1953	46	110	45	201	—
1954	58	62	37	157	600
1955	60	73	26	159	—
1956	57	67	47	171	773
1957	61	55	29	145	—
1958	75	70	72	217	325
1959	86	86	63	235	—
1960	69	76	71	216	1267

Changes in livestock programs. Major changes in livestock numbers were made after the son entered the farm business. An average of 725 hens was kept for the first five years. Numbers of hens were increased to 1000 in 1953 and ranged from 2,150 to 2,800 for the following years. All eggs marketed prior to 1954, were sold for consumption uses. A market had been established with local restaurants and through delivery service to regular customers. This practice was continued throughout the period, but, as the commercial flock was increased, some surplus eggs had to be sold through a wholesale establishment. A hatching egg flock with broiler-type hens was added in 1954. This flock averaged about 1,000 hens, and eggs were marketed on a contract basis through a local hatchery.

Egg production per hen varied considerably over the period, ranging from 136 eggs in 1948 to 269 in 1952 (Table XIX). The lower output per hen in the period 1954-56 was possibly associated with problems of establishing the hatching egg enterprise. Output of eggs per hen was affected adversely in some years also by disease problems in the flock.

Cows, mostly of beef type, were kept primarily for production of meat and milk for home use. The number of cows was increased to six in 1953, eight in 1956, and to nine in 1958. The calf crop was 100 per cent for ten of the thirteen years; in 1956 it was 37 per cent, in 1955 73 per cent, and in 1960, 90 per cent. A few calves were purchased each year after 1953, fed and grazed through the fall and early spring months and sold as grass fat steers in late spring. The number of calves bought ranged from five to ten, depending on the amount of surplus feed and grazing available.

TABLE XIX
LIVESTOCK PRODUCTION AND RELATED FACTORS
CASE FARM 4

Year	Average number hens	Number eggs per hen	Number cows	Per cent calf crop	Number sows ^a	Number pigs per sow	Average price eggs per dozen
1948	634	136	3	100	3	21	.61
1949	765	160	2	100	3	12	.57
1950	833	182	2	100	3	16	.50
1951	720	184	2	100	2	14	.59
1952	675	269	3	100	2	19	.51
1953	1000	216	6	100	2	15	.50
1954	2200	165	6	100	2	9	.47
1955	2150	162	6	73	2	13	.67
1956	2315	159	8	100	3	9	.74
1957	2800	178	8	37	3	16	.61
1948	2615	195	9	100	3	15	.60
1959	2350	212	9	100	3	11	.50
1960	2500	198	9	90	3	12	.63

^aSows are considered as gilts or sows kept for twelve months of more.

Hogs were kept mainly as a supplemental livestock enterprise. An average of three sows were kept eight of the thirteen years and an average of two were kept each of the remaining five years. Efficiency, in terms of pigs raised per sow, varied rather widely during the period of study ranging from 9 to 21 and averaging 14.4 for the entire period.

Change in the labor force and efficiency. Operator and family labor was the predominant labor force throughout the thirteen-year period. Some seasonal hired labor was used eleven of the thirteen years, ranging from one to ten months and averaging two and one-half months per year. Total months of labor used per year in the farm business ranged from sixteen to thirty four. The son's return to the farm and the additional land acquired in 1953 added to both the labor supply and requirements. As the poultry enterprise was expanded more of the operator's labor was utilized in poultry production and marketing. Hired labor was being used only in the production and harvesting of crops. The purchase of a corn picker and grain conveyor in 1959 eliminated much of the need for hired labor.

Volume of business, in terms of productive work units, increased from a low of 245 in 1949 to a high of 569 in 1957. The largest change was made in 1953 with some increase in the following years (Figure 20). Labor efficiency, in terms of productive work units per man, decreased during the first five years but tended to increase during the remainder of the period. The increase in size of the farm operation, from the standpoint of acres used and livestock numbers, and increased machinery use were possible factors in the increased efficiency of labor.

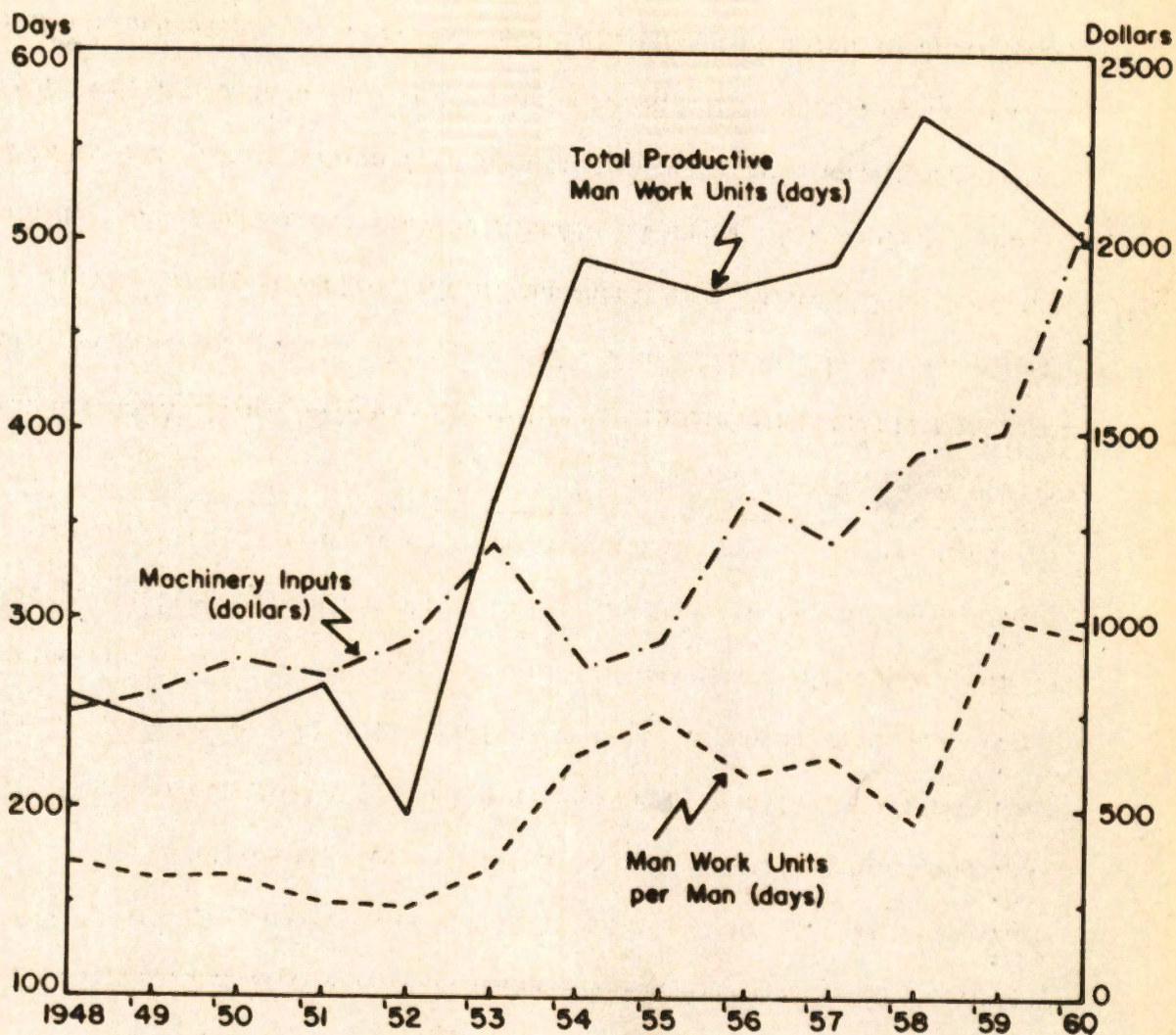


FIGURE 20

TOTAL PRODUCTIVE MAN-WORK UNITS, LABOR EFFICIENCY
AND MACHINERY INPUTS, CASE FARM 4

Changes in capital investment. Land values were held constant during the thirteen-year period with two exceptions: these values were increased in 1953 due to the purchase of 35 acres of additional land and in 1954 due to some major land improvements made on the land purchased the previous year (Figure 21).

The value of buildings increased more than did other items of capital investment. Over the thirteen-year period values of buildings increased about 350 per cent. These increases were made through major improvements to the dwellings, additional buildings acquired through purchase, construction of an additional poultry house, machine shed, and egg grading and cooling room, along with repairs and additions to various other buildings.

Livestock inventory values fluctuated over the years with major changes in values resulting largely from changes in numbers and values of poultry in the laying flocks. Values of livestock inventories increased approximately twenty-five per cent between 1948 and 1960. Although the livestock enterprise was the predominant source of income, inventory values of livestock increased less over the thirteen-year period than did any other item of capital; this was due, largely, to the decreasing market value of live poultry.

The value of machinery and equipment on this farm increased gradually over the first eleven years. Machinery on the farm was valued at \$5,258 in 1948, but rose to \$7,520 in 1958, or a 43 per cent increase. An increase to \$13,224 in 1960 amounted to an overall additional value of about 250 per cent for the entire period. Values of machinery increased 35 per cent in 1959 and 30 per cent in 1960. Investments in

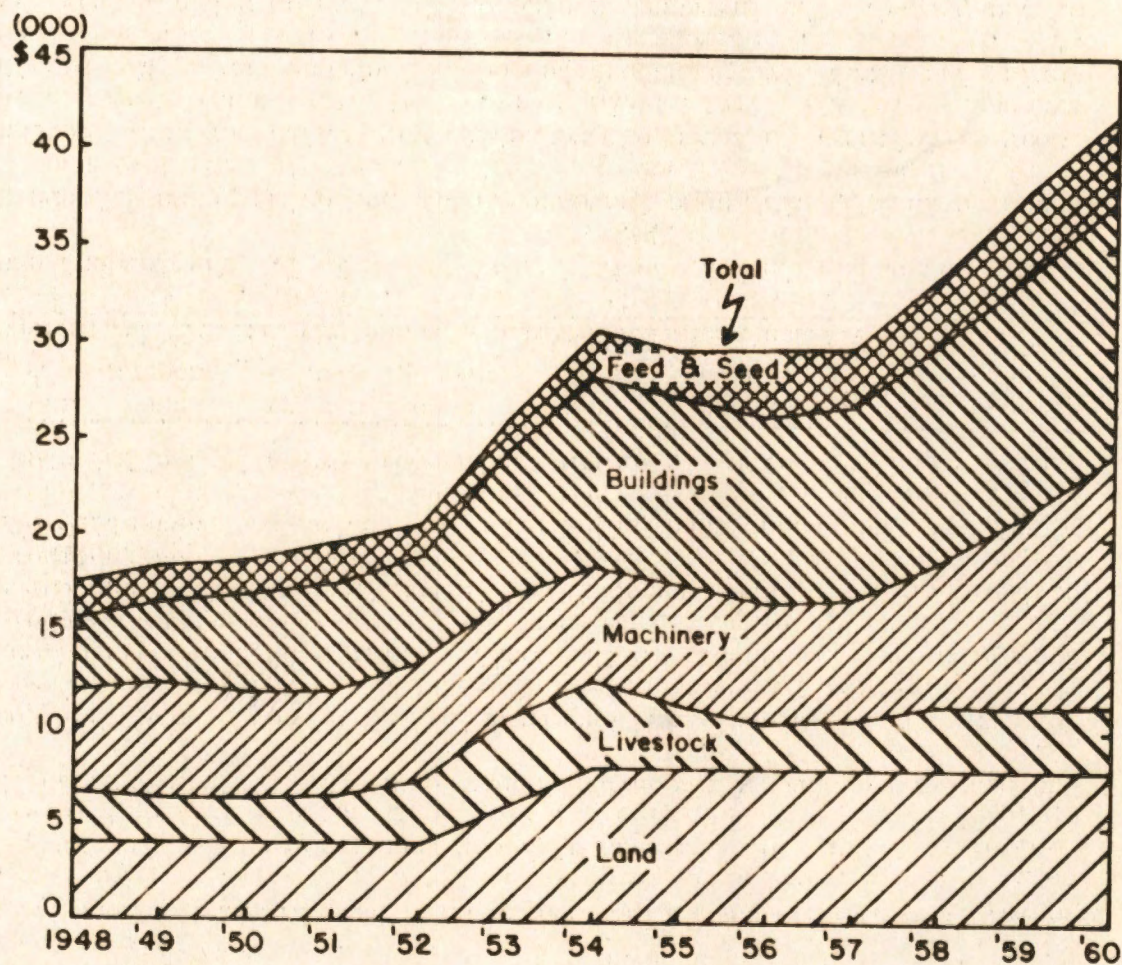


FIGURE 21

CAPITAL INVENTORY VALUES, CASE FARM 4

machinery during the last two years were for a corn picker, grain elevator, tractor, truck, poultry equipment, and a number of items of small equipment.

Stored feed that was produced on the farm represented most of the value of feed and seed inventory values. The fluctuation of values, ranging from \$1,624 in 1953 to \$4,313 in 1960, were due to changes in crop yields and varying amounts of the current year's crop fed to livestock and poultry. Values of feed and seed averaged \$1,832 per year for the first six years and \$3,553 for the last six years, averaging \$2,673 for the entire period.

Change in income and expenses. Total cash receipts ranged from \$7,852 in 1948 to \$32,415 in 1960 and increased each year over the previous year except in 1959. A small reduction in the poultry flock, and about a 17 per cent reduction in the price received for eggs, accounted for most of the \$4,201 reduction in cash receipts from 1958 to 1959. The largest increase in cash receipts was made from 1952 to 1953 when additional land was acquired, the son returned to the farm, and the poultry flock was increased from 675 to 1,000 layers. Average cash receipts per year were \$10,649 for the first six years, \$29,575 for the last six years, and \$19,902 for the entire period (Figure 22).

Cash income was predominantly from eggs, which accounted for 74 per cent of the cash income for the entire period. Since sales of poultry amounted to 16 per cent of the cash receipts, the poultry enterprise contributed 90 per cent of all cash income for the entire thirteen years. Hog sales averages 4 per cent, cattle 4 per cent, and crops 2 per cent of all farm sales during the thirteen years.

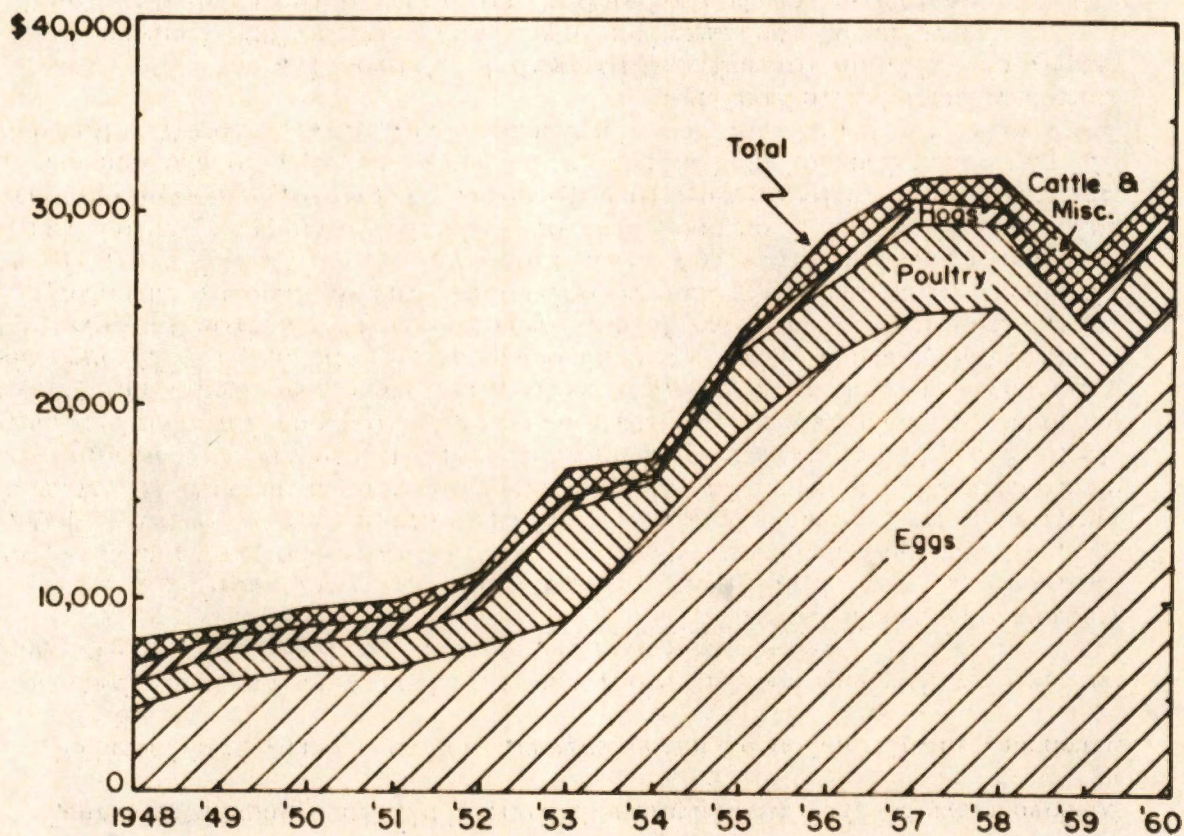


FIGURE 22

VARIATIONS IN CASH RECEIPTS BY SOURCES, CASE FARM 4

Operating expenses were largely for feed and livestock, with these items accounting for over 50 per cent of all operating expenses during all years except 1948. Total expenses increased from \$3,926 in 1948 to \$22,519 in 1960, with the greatest expense being in 1958 (Figure 23). Expenses for labor averaged less during the last half of the period than during the first half. The expenses for all other items were considerably greater during the later years.

Seed and fertilizer expenses increased from a low of \$660 in 1948 to a high of \$2,183 in 1960 and machinery costs were \$746 and \$2,092 for the corresponding years. These expenses were associated to a large degree with the feed production program. The expense of buildings and other items varied, over time, but were considerably higher during the later years of this period.

Operating expenses, as a per cent of cash receipts, averaged about 74 per cent for the first six years, 71 per cent for the last six years, and 73 per cent for the entire period. Total cash receipts were 278 per cent higher for the last six years than for the first six, while expenses were 265 per cent higher for the corresponding period. This is accounted for, to some extent by a decrease in feed and livestock costs and higher prices received for eggs during the later period.

Net farm income, varying from a -\$767 in 1954 to \$11,678 in 1960 averaged \$5,617 for the entire thirteen-year period. A considerable increase was made in net farm income during the later years of the period. Net farm income averaged \$3,248 for the first six years and \$9,045 for the last six years of the study.

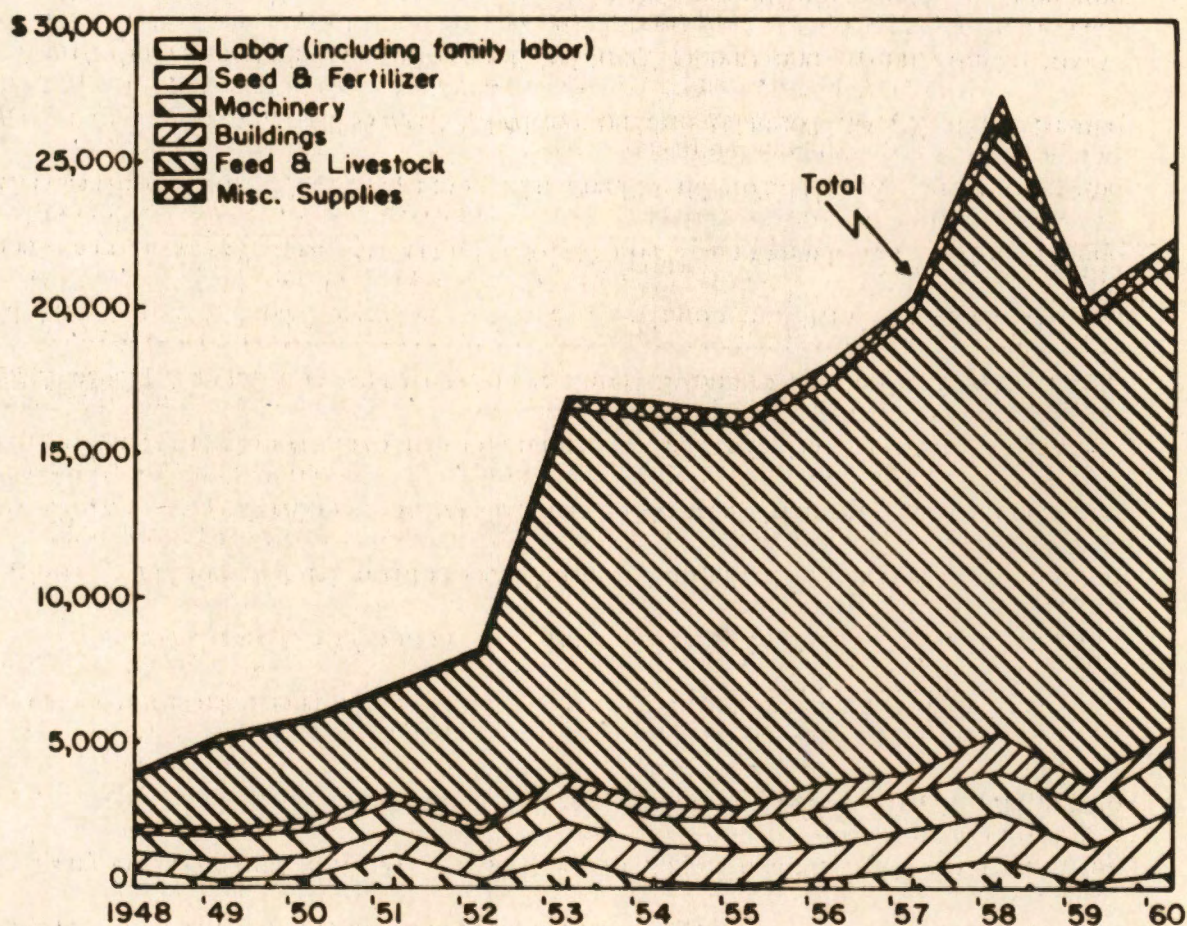


FIGURE 23

VARIATION IN OPERATING EXPENSES BY SOURCES,
CASE FARM 4

The variation in net farm income was greater, over time, than for either cash receipts or operating expenses. The coefficient of variation for net farm income was 68 per cent, cash receipts 50 per cent, and operating expenses 52 per cent. The wide fluctuation in values of feed, seed, and livestock inventories accounts for most of the great difference in variation of this measure of income (Table XX).

Capital turnover averaged about 70 per cent for the thirteen-year period and ranged from 42 per cent in 1948 to 105 per cent in 1957 and 1958. The per cent of total capital in non-real estate capital ranged from 40 per cent to 56 per cent, averaging about 47 per cent (Figure 24).

Summary of farm adjustments on case farm 4. As indicated by land use, livestock production, capital investment, expenses, and income, relatively small adjustments were made in the farm organization prior to 1953. The need for additional income, to support the son and his family when he became a partner in the farm business, brought about pressures for expansions in farm outputs. Land resources were quite limited, totaling about 65 acres of open land after acquisition of additional land in 1953. Labor and capital resources were available, but limited land restricted the number and size of many enterprises suited to this particular farm. The opportunity to utilize all resources more fully in poultry production and the accessible markets for poultry products were influential factors in the decision to expand the poultry enterprise.

Land uses were changed primarily to increase grain production and quality of grain for use in the poultry enterprise. High yields

TABLE XI

AVERAGE INCOMES, EXPENSES, AND VARIATIONS FROM
THE AVERAGE, CASE FARM 4, 1948-60

Item	Average	Standard deviation	Coefficient of variation
Total cash receipts	\$19,902	\$9,964	50
Change in inventory	287	1,468	511
Operating expenses	14,572	7,623	52
Net farm income	5,617	3,824	68

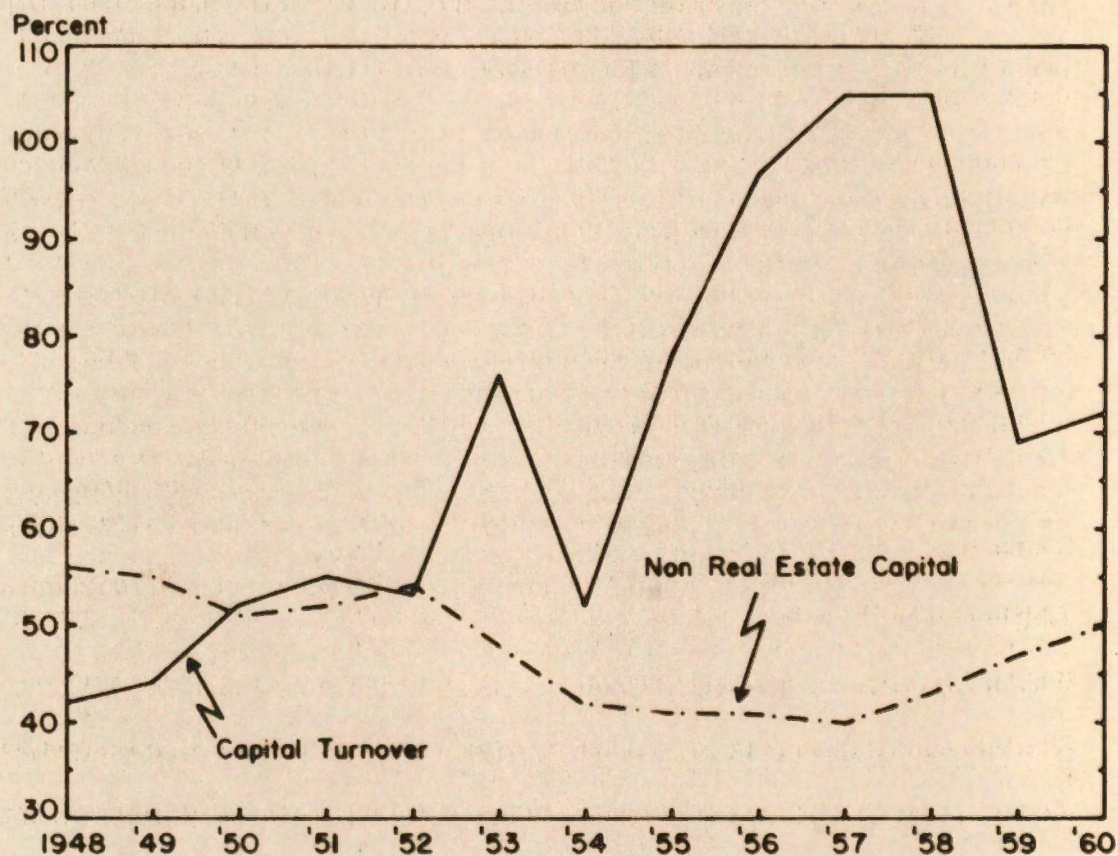


FIGURE 24

RELATIONSHIP BETWEEN PER CENT OF TOTAL INVESTMENT IN
NON-REAL ESTATE ASSETS AND CAPITAL TURNOVER,
CASE FARM 4

of corn were maintained throughout most of the thirteen-year period through use of poultry litter, green manure crops, and high rates of commercial fertilizers. Extreme droughts of 1952 and 1954 reduced corn yields considerably.

Increased inputs of machinery and the increased size of the farm operation resulted in increased labor efficiency and outputs of products. These were especially important factors in maintaining a relatively high income during the last six years. During this period of generally increasing farm operating costs and decreasing prices of farm products, this operator reduced costs per unit of output slightly and received slightly higher prices for eggs, which were the major source of farm sales. The addition of the hatching egg flock accounted for the higher prices received for eggs. Relatively high output per bird was maintained even after the addition of the broiler-type hatching-egg flock. Eggs produced per hen averaged 193 during the first six years and 185 during the last six years of the thirteen-year period.

A number of factors were possibly associated with the decision to concentrate resources in an expanded poultry enterprise. These included a need for increasing income when the son returned to the farm, managerial abilities gained through several years of experience in poultry production, the established market for commercial eggs and the opportunity to produce and market hatching eggs.

CHAPTER V

SUMMARY AND CONCLUSIONS

This study of case farms in the Limestone Valley and Appalachian Plateau regions of Alabama was undertaken to describe adjustments made in farm organizations and operations on individual farms over the thirteen-year period, 1948-60. The major concerns were with changes occurring on these farms, conditions influencing these changes, and resulting effects on net farm income. Since the operators of the case farms analyzed were cooperators in the Test-Demonstration Program of North Alabama, detailed farm business records were available for each farm over the entire thirteen-year period.

Two of the case farms were located in the Appalachian Plateau region and two were located in the Limestone Valley region of North Alabama. Records from each farm were analyzed and data summarized on an annual basis, in order to observe adjustments made in farm operations and organizations and to measure actual results in terms of changes in incomes. The procedure included an analysis of changes in land use and output, livestock production and output, uses of commercial fertilizer, farm expenses, labor force, and capital investment. Whenever possible specific adjustments were related to changes in physical and economic conditions under which the farm was operated.

I. ADJUSTMENTS ON CASE FARMS

Land use on Case Farm 1 was oriented primarily to production of cash crops. These crops were cotton, corn, small grain, and sweet

potatoes during the early years of the study. Over time cotton acres were reduced because of reduction in government allotments, corn and wheat acres were increased, and sweet potatoes were discontinued due to lower prices and labor competition with other crops. The forage program was shifted to higher producing and more valuable crops, with lespedeza and grain sorghum being discontinued and acres diverted to alfalfa, pasture, and millet.

Higher rates of commercial fertilizer and better balanced ratios of plant nutrients along with the adoption of other improved practices resulted in increased outputs per acre.

The livestock program was primarily a beef cow and calf herd until 1957 when hog production was increased. Farrowing facilities were improved, the number of sows kept was increased, and improved management practices resulted in considerably increase in number of pigs raised per sow. The expansion of the hog enterprise helped to achieve a more even seasonal distribution of labor requirements over the year. The improvements in distribution of labor along with increased use of machinery were important factors contributing to increased labor efficiency.

These adjustments in farm organization and operation were accompanied by increases in capital outlay for land, buildings, machinery, and livestock along with increased operating expenses. This was also a period in which expenses as a per cent of cash receipts gradually increased. Expansion in size of operation, increased labor efficiency, increased output per unit of crops and livestock, expanded grain and hog enterprises, and the improved forage production program were functions that contributed to maintaining the relatively high income on this case farm despite

steadily rising prices of input items and some declines in product prices over the period.

Dairying was the major enterprise on Case Farm 2 throughout the thirteen-year period, 1948-60. Land resources were limited to 100 acres of tillable land in 1948 but were gradually increased to 112 acres in 1957 by clearing of additional land.

Land use on this case farm was shifted entirely to forage production with forage crops replacing grain and cotton acreages. Forage crops with higher nutritive values were substituted for less desirable crops, with considerable increases in land devoted to alfalfa, improved pasture, and grasses for summer grazing.

Increased milk production per cow was possibly due in part to improvements in the forage program and higher yields of these crops through application of a better balance in plant nutrients. This increased output per cow may also have been associated with improvements in the dairy herd through better breeding practices and selection of replacement cattle.

Labor efficiency improved gradually during the later years of the period and was associated with both an increase in the number of cows in the dairy herd and increased use of machinery.

These farm adjustments resulted in an 88 per cent increase in capital investment, with operating expenses increasing considerably over time. Net farm income averaged \$820 per year greater for the last six years of the period as compared to the first six years. Yet net farm income as a per cent of gross receipts was about 10 per cent less for

the corresponding period. The increased net farm income was possibly a function of increased output per cow, increased number of cows in the dairy herd, improved labor efficiency, improved forage program, and increased outputs of forage crops.

In 1960 the dairy enterprise was discontinued and a beef system was substituted. This shift was due to a number of factors, including the necessity of making considerable additional investments in bulk handling facilities for milk. Since land resources were too limited to permit an adequate size unit to support both the father and son, the son decided to seek employment off the farm. Due to the operator's advancing age and the already well developed forage program on the farm, beef seemed to be the best alternative.

Case Farm 3 was a diversified livestock farm, and dairying and egg production were the primary sources of farm receipts. Land use was centered around feed and forage production for these livestock enterprises. Frequent adjustments were made in land uses with trends toward increased acres of alfalfa, winter cover crops, and summer grazing crops. Crop yields varied from year to year but in general were relatively high due to improved practices followed. The poultry enterprise was discontinued in the later years of the period because of declining egg prices, developments in health conditions of the operator's wife which prevented her from handling the processing and marketing of the poultry and eggs, and a reduction in amount of other family labor available for farm work as the children left home for other employment.

Dairy production was increased during the later years of the period through increased outputs per cow and increased numbers of cows in the

herd. Loss of income from the poultry enterprise, capital investment in bulk handling of milk, and more stable prices for dairy products than for certain other products were factors involved in specializing in the dairy program.

Labor efficiency was increased gradually over time. Volume of sales was increased and cash receipts increased slightly over the thirteen-year period. However, costs of production increased more than did cash receipts, resulting in a reduction of returns to the operator in terms of net farm income. The completion of the operator's objective to educate the four children and the consequent reduced financial responsibilities possibly reduced the incentive to maximize profits on this case farm.

The farm organization of Case Farm 4 was largely a function of fitting resources to a specialized poultry enterprise. Major adjustments developed after a son returned to the farm. This additional family created pressures to increase farm income. An additional 36 acres of land was purchased in 1953.

Land use was primarily devoted to grain production to be utilized in the poultry-feed program. Winter cover crops were produced in a double-cropping system with corn and were utilized to some extent in a grazing program for the small beef cow and brood sow herds. Land unsuited for row crops was devoted to pasture and seresia and a small acreage of alfalfa was maintained to provide feed for livestock. Corn production replaced grain sorghum and oats as grain crops because of higher yields and the relatively higher feed value of corn as a poultry feed.

Crop yields were relatively high throughout the period. Heavy rates of commercial fertilizers, green manure crops, and poultry litter were factors in maintaining the high crop yields.

The poultry flock was increased when the son became a partner in the farm business in 1953 and a broiler-type laying flock was added the following year. With the exception of a low production period in 1954-56, egg production per hen was maintained at a relatively high level during the later years.

Volume of business in terms of total productive man-work units were almost doubled during the thirteen-year period. Labor efficiency was increased through increased use of machinery and increases in farm acres and livestock numbers.

Capital investments were increased as the farm operation was expanded. These increases resulted in higher cash receipts from the farm operation but were accompanied by increasing costs. However, this operator, through good management and marketing practices reduced costs per unit of output and received slightly higher prices for eggs during the later years of this period. These developments, along with expansions in the land resources and the poultry flock, were the major adjustments associated with the substantial increase in net farm income.

CONCLUSIONS

Although farmers operating in the same general region face similar general economic conditions, each operator has adjustment problems that are peculiar to the individual farm resource situation. While one farm operator finds it necessary to adjust the farm organization to one condition, others may have quite different adjustment problems.

Case farms of this study were faced with varied adjustment problems. On Case Farm 1, reduction in cotton allotments made it necessary to reorganize the land-use program. Disease problems in the livestock herd in 1955 forced the operator to dispose of part of the herd and consequently resulted in a temporary reduction in net farm income. On Case Farm 2, the return of a son to the farm created a need to expand the volume of business in order to utilize the expanded labor force more fully. In 1960 the operator of this farm, faced with the necessity of installing bulk and milk-handling facilities, shifted his major enterprise from dairy to beef. On Case Farm 3, deterioration in health of operator's wife and substantial declines in prices of eggs forced a major shift in enterprises. On Case Farm 4, the major problem was that of reorganizing the farm business when a son and his family became partners in the business in 1953.

All case farms had highly variable crop yields, varying expenses and fluctuating net farm incomes. Each operator made substantial increases in capital investments, increased output per unit of crop and livestock, and increased labor efficiency. Yet farm returns, in terms of net farm income, were not increased in proportion to increased in cash receipts on three of the four farms. This was a result of the increasing cost situation that existed during the period.

Because of the varying adjustment problems from one farm to another it is quite difficult, if not impossible, to apply the adjustments made on these farms to farm operations in general or even to farms of a similar resource base. It has been clearly demonstrated that adjustments

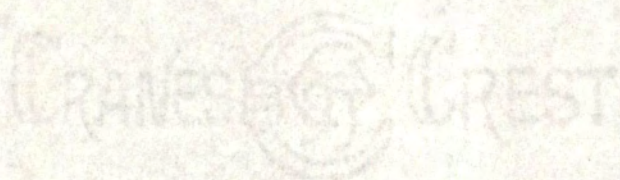
were necessary on all case farms if profits were to be maximized or if incomes were to be maintained over this particular period. These adjustments required considerable increases in capital outlay and increased expenses. These expenditures were for increased specialization and increased outputs with the exception of Case Farm 1 which added a livestock enterprise while increasing outputs in all enterprises. Although the adjustments made on these farms may not be satisfactorily applied to other farming operations in general the study of these adjustments and their effects on farm incomes could serve a useful purpose in illustrating the necessity for and the results of adjustments in these particular situations. Farmers of the area and in similar situations may find them useful as a guide in developing plans for adjustments.

BIBLIOGRAPHY

BIBLIOGRAPHY

- Boss, Andrew and Pond, Georgia A. Modern Farm Management Principles and Practice. St. Paul: The Webb Publishing Company, 1947.
- Bracheen, L. G. Soils of Alabama, Soil Survey, Department of Agriculture and Industry, Montgomery: 1953.
- Bradford, Lawrence A. and Johnson, Glenn L. Farm Management Analysis, New York: John Wiley and Sons, 1953.
- Chastain, E. D., and Yeager, Joseph L. Farm Management Concepts and Principles with Application to Southern Agriculture. Auburn: 1958.
- Johnson, Glenn L. and Haver, Cecil B. Decision-Making Principles in Farm Management, Kentucky Agricultural Experiment Station, Bulletin 593, Lexington: 1953.
- Sowell, W. F. Alabama Soil Test Summary, Unpublished data, Auburn University, Auburn: 1960.
- Strand, Edwin G. and Heady, Earl O. Productivity of Resources Used on Commercial Farms, Iowa Agricultural Experiment Station, Technical Bulletin No. 1123, Ames: 1955.
- Wheeler, Richard G. New England Dairy Farm Management Project as an Example of the Operating Unit Approach to Farm Management Analysis, Journal of Farm Economics, 32; 1950.
- Wilkening, Eugene A. Acceptance of Improved Farm Practices in Three Coastal Plains Counties, North Carolina Agricultural Experiment Station Bulletin 98, Raleigh: 1952.
- Woodworth, Roger C. and Saunders, Fred B. Evaluating Income Opportunities on North Georgia Farms, Athens: cooperating with Tennessee Valley Authority, 1956.
- Young, Pauline V. Scientific Social Surveys and Research. New York: Prentice-Hall, Inc., 1956.

APPENDIX



APPENDIX A

TABLE XXI

ANNUAL RAINFALL BY MONTHS AT GUNTERSVILLE DAM,
ALABAMA, 1948 THROUGH 1960^a

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
	Inches												
1948	3.45	9.58	6.37	3.20	2.89	2.37	4.54	2.07	2.68	0.37	13.93	3.97	55.42
1949	10.08	5.77	5.16	2.87	5.37	6.80	3.75	4.26	3.66	7.00	1.17	3.48	59.37
1950	6.25	3.80	8.47	2.04	3.73	4.08	5.26	5.24	4.23	1.73	1.74	2.86	49.43
1951	4.66	6.17	10.23	5.71	0.95	6.42	3.71	2.70	6.87	5.05	5.18	9.32	66.97
1952	5.36	2.96	6.19	1.06	4.93	4.05	1.26	6.12	2.23	3.50	2.94	4.48	45.08
1953	6.73	6.40	3.35	6.95	2.84	2.80	3.01	0.17	4.89	0.36	1.30	7.28	46.08
1954	8.51	3.02	4.38	3.52	4.09	1.17	2.94	1.04	1.37	1.58	4.03	4.32	39.97
1955	3.51	6.87	7.22	3.89	4.11	2.43	6.76	3.06	0.25	3.22	3.22	2.15	46.69
1956	1.57	11.41	4.72	4.38	2.96	1.46	3.55	3.03	1.36	1.87	3.50	7.20	47.01
1957	5.39	7.63	2.35	3.53	3.08	3.37	2.13	4.01	4.97	2.68	11.52	4.17	54.83
1958	2.43	4.01	3.72	8.01	1.12	3.01	4.93	4.42	2.32	1.13	3.25	1.19	39.54
1959	4.02	3.06	4.98	4.01	5.96	2.18	3.20	3.52	3.90	3.25	4.08	3.31	45.47
1960	5.00	2.65	7.40	2.32	2.50	2.45	3.00	7.95	5.30	4.22	3.40	2.48	48.67
Av.	5.15	5.64	5.73	3.96	3.43	3.28	3.69	2.66	3.39	2.77	4.56	4.32	49.58

^aSource: Tennessee Valley Authority, Hydraulic Data Branch

APPENDIX A (continued)

TABLE XXII

ANNUAL RAINFALL BY MONTHS AT WHEELER DAM, ALABAMA,
FOR 1948 THROUGH 1960

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
							Inches						
1948	3.67	12.97	8.87	2.43	4.15	2.78	5.01	0.58	2.68	0.76	11.92	4.73	60.55
1949	13.98	3.57	6.64	2.23	3.05	3.93	4.73	7.27	3.03	3.57	0.99	4.23	57.22
1950	13.96	7.67	7.96	2.08	4.06	3.67	9.35	8.08	3.30	0.58	4.76	3.40	68.86
1951	4.98	7.40	9.55	5.71	0.30	5.20	3.21	0.59	4.46	1.90	5.67	13.57	62.54
1952	8.03	3.77	6.97	1.93	2.52	1.49	2.36	6.06	3.18	2.55	4.09	6.05	49.00
1953	6.38	9.54	4.93	7.27	5.37	2.36	4.52	1.21	3.97	0.24	0.63	5.95	52.37
1954	10.92	2.85	1.61	5.99	4.75	2.18	0.69	1.29	0.92	2.23	2.86	8.77	45.06
1955	2.63	7.84	8.41	6.67	7.80	1.46	6.75	1.06	0.66	2.20	3.25	5.34	54.07
1956	3.51	8.95	3.51	8.63	1.88	4.70	2.49	3.23	0.88	2.33	2.04	10.20	52.35
1957	8.06	7.73	3.13	4.76	3.12	3.21	4.05	5.39	6.66	3.04	10.10	4.44	63.70
1958	2.91	4.35	3.66	9.07	5.60	4.00	13.44	2.40	4.85	0.55	4.27	0.42	55.52
1959	4.30	3.92	4.56	3.83	4.58	1.95	4.43	3.11	2.78	5.38	4.42	8.11	51.37
1960	5.67	3.10	6.77	1.86	2.79	2.32	1.97	3.26	3.35	5.70	4.07	2.98	43.84
Av.	6.85	6.44	5.88	4.80	3.84	3.02	4.85	3.35	3.13	2.39	4.55	6.01	55.11