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I am submitting herewith a thesis written by Dennis J. Weller entitled "The Potential for Increasing Net Incomes on Limited Resource Farms in Upper East Tennessee." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

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THE POTENTIAL FOR INCREASING NET INCOMES ON LIMITED RESOURCE FARMS IN UPPER EAST TENNESSEE

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Dennis J. Weller

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This study would not have been possible without the continual optimism given by my wife, Debbie.

ABSTRACT

The overall objective of this study was to explore the possibilities for improving the net farm income positions of full-time limited resource farm operators in Upper East Tennessee. The improvement in income was based on the optimal employment of available resources to produce a unique enterprise mix which maximized income.

Forty full-time farmers with gross earnings of less than $10,000 in 1976 were interviewed. Five decision variables were used to group the survey farms into homogeneous limited resource farm groups. These variables were land-labor index, tobacco space index, dairy enterprise potential, net income observed for each farm, and potential net income. Resources of a farm were used in a linear program to maximize the incomes of each farm and the results averaged within the appropriate limited resource farm group.

Seven situations were analyzed which varied the assumptions and constraints. The analyses were divided into two categories: (a) those limiting enterprise alternatives to those that existed on a farm when surveyed, and (b) those allowing varying degrees of enterprise mobility. Each analysis incorporated either variable expenses into the objective function which represented a short-run solution, or variable and fixed expenses which represented a long-run solution. The results of these situations represented the income potential of limited resource farmers ranging from incorporation of static to dynamic conditions into the model.

The resource advantages of the different levels of resource base farmers tended to decline in relative importance as income generating labor available was fully utilized for all limited resource farm groups. The most limited resource group of farmers was observed to have a net income of $1,319 while the relatively least limited resource group of farmers had an income of $15,533. When feeder pigs were allowed to enter, incomes were allowed to be maximized the most to $7,208 and $22,846 for farms in Group 1 and Group 4, respectively. The major enterprises generating this income were feeder pigs, corn, pasture, and tobacco. Disallowing feeder pig production and allowing the substitution of hay and tobacco capacity was the next best alternative for the limited resource farm groups. This situation had the effect of doubling tobacco production over observed bench mark levels while leaving the other enterprise levels unaffected. The least dynamic program restricted enterprises allowed to those observed on a farm, allowed for no vegetable or feeder pig production on farms where these enterprises were not observed, allowed for no substitution of hay space for tobacco space, and limited the amount of tobacco quota leased-in to 1,575 pounds per farm. This program allowed the farm to increase their incomes by an average of 27% in the short-run to an average of $6,908 per farm.

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CHAPTER I

STATEMENT OF THE PROBLEM

I. INTRODUCTION

> In the densely populated sections, where the majority of farms are roughly forest land, the area that can be used for growing crops is limited and under present management and practice, hardly enough land is available to produce the food necessary for home consumption (Arnold, 1918, p. 5).

Although this statement was made 70 years ago, low farm income remains a problem today for many farm families in the mountainous Appalachian area of the South. Since the 1930's the United States has moved to a highly mechanized, technologically advanced, and highly productive agricultural sector. This transformation has benefited consumers in general by allowing them to spend proportionately less of their disposable income on food purchases. It has, on the other hand, produced the undesirable effect of many farm families with abundant labor resource being "left behind." These farm families are characterized as having low incomes and limited resources.

Programs have been developed to assist these farm families who live outside the mainstream of the commercial agricultural sector. The implicit assumption common throughout these programs is that low-income, limited resource farm operators aspire to and, in fact, can improve their incomes, given a certain set of resources, through the adoption of recommended management practices as well as engaging in the most profitable enterprises. The use of farm resources which are

underutilized may be socially more desirable than direct transfer payments as a means for raising the income level of low-income, limited resource farm families to acceptable levels.

II. OBJECTIVES

The overall objective of this study was to explore the possibilities for improving the net income positions of full-time, limited resource farm operators in Upper East Tennessee. The objective was based on the assumption that less-than-optimum enterprise combinations exist on limited resource farms. Recombining resources available to the farms surveyed to produce a unique, optimum enterprise combination within a framework of specified prices, technologies and resource restrictions was the adjustment by which to maximize farm income. In exploring these possibilities, resources which effectively limit the productive potential of farmers could be identified and monetary values for resources could be established.

The specific objectives of this study were:

1. To determine the current resource conditions and enterprise combinations of full-time farm operators in Upper East Tennessee with gross sales of less than $10,000 per year.
2. To estimate increases in net farm income of these farm operators resulting from an optimal mix of available resources using specified technological and price conditions.
3. To identify those groups of farm firms having the greatest potential for increased net income.

III. PROCEDURE

A random area sample was taken in 12 contiguous counties[1] located in the Appalachian area of Tennessee commonly referred to as Upper East Tennessee. Approximately 530 cluster areas were delineated within the region with the number of farms in each county as reported by the *U.S. Census of Agriculture*, 1969. Forty cluster areas were randomly selected and each household in the areas was contacted in 1975 to determine if a farm operator resided in the household. These operators were then interviewed and stratified into the following four groups:

1. Part-time - age < 65; off-farm employment $\geq$ 100 days per year.
2. Full-time - age < 65; off-farm employment = 0 days per year.
3. Other - age < 65; off-farm employment < 100 days, but > 0 days per year.
4. Older - age $\geq$ 65.

Of the 287 farmers initially interviewed in 1975, 45% were categorized, according to a classification by Garett (1976), as part-time; 29%, full-time; 10%, other; and 16%, older. The farm operators making up the target group for this study included all those operators in the sample of 287 farmers earning less than $10,000 gross income in 1975 and having off-farm employment of less than 100 days in the same year. Furthermore, the operator in this subsample was required to be actively involved in managing and operating the farm firm. Seventy-one farmers

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[1]Counties included are Carter, Cocke, Grainger, Greene, Hamblen, Hancock, Hawkins, Jefferson, Johnson, Sullivan, Unicoi, and Washington.

were subsequently classified as low-income and full-time for purposes of this study.

To meet objective (1), a questionnaire was administered in 1977 to the limited resource farm operators identified in the subsample. Based on this second questionnaire, the 1976 status of the 71 full-time, low-income farm operators identified by the initial questionnaire was determined (Table 1). Of these, 40 operators (56%) were contacted and personal interviews conducted which detailed information such as levels of the operators' labor, land, and machinery resources, enterprise activities, income positions, and attitudes toward expanding the then current enterprises or engaging in new ones. Twenty-four operators were subsequently classified as earning less than $10,000 in 1976. Twelve operators surveyed reported that they had increased their incomes to more than $10,000, and four had become partially retired. The resource situation of all 40 farmers, however, was used in the study. The remaining operators (44%) were either contacted, or an attempt to do so was actively made, and subsequently classified into the groups delineated in Table 1. The most important reason for these operators identified no longer satisfying the full-time, limited resource conditions was attributed to retirement from active farming. Six operators previously identified as full-time and low-income had left farming for alternative employment.

The second objective was accomplished in two stages. First, costs and returns of the various enterprises engaged in in the survey area were estimated and incorporated into standard budgets. Second, linear programming techniques were applied under varying technological

TABLE 1. Status of Full-Time, Limited Resource Farm Operators Identified by the 1975 Questionnaire

Status	Number	Percent
Contacted and Interviewed:		
Earning greater than $10,000 in 1976	12	16.9
Earning less than $10,000 in 1976	24	33.8
Partially retired but considered full-time and gross earnings less than $10,000	4	5.6
TOTAL OPERATORS INTERVIEWED	40	56.0
Contacted and Not Interviewed:		
Retired from active farming	8	11.3
Farming only part-time	3	4.2
Employed in other occupation; no longer farming	6	8.5
Unable to locate	2	2.8
Operator inadequately identified on initial survey form	4	5.6
Deceased	4	5.6
Repeated attempts, operator not at home	1	1.4
Interview refused	3	4.2
TOTAL OPERATORS NOT INTERVIEWED	31	44.0

Source: Survey of 287 Farmers in Upper East Tennessee, 1975.

and price conditions to each farm. The net incomes resulting from optimal enterprise combinations, using maximization of net income as the objective function, were then compared with a benchmark level estimated from the survey questionnaire.

The final objective was met by categorizing the farms into four homogeneous groups according to their potential for increased income. Five decision variables were used in grouping the farms: land-labor index, tobacco space, dairy enterprise potential, income resulting from observed enterprise levels, and income resulting when enterprise level adjustments were allowed. The importance of additional resources potentially available to farm operators was measured by the average increase in net income for each group which resulted from the employment of an additional unit of a given scarce resource.

IV. REVIEW OF LITERATURE

The attainment of equality between farm income and that of nonfarm income has long been a goal for both farm operators as well as agricultural policy-makers. Johnson (1964) gave full impetus to research directed toward this income equality goal by indicating that farm workers have a labor capacity approaching that of semi-skilled and skilled workers in the same age and sex group of the economy's nonagricultural sector.

A comparison of farm and nonfarm income, however, indicates that returns in agriculture to labor and capital are considerably lower, relative to nonfarm industries. Tweeten (1965) considered that only farms with gross sales of $40,000 or more generated net

labor-management returns equal to factory workers' incomes.

The unanswered question, therefore, of what constitutes equality of income between these two sectors is difficult and many definitions have been offered. Brewster (1958, p. 9) stated the problem as:

> . . . the determination of the amounts and kinds of resources needed to enable farm operators to have levels of money earning comparable to industrial workers, and then do the best that can be done in pointing up the respects in which significant differences in "real" values may be associated.

Low and declining income then has been the principal reason why farmers have continually had to make adjustments to maintain and improve their economic position. Adjustment possibilities available to farm operators, as noted by Roy (1974) are:

1. Upgrade the *technology* employed on the farm to increase output per unit of input,
2. *Shift farm enterprises* from low return to higher return ones,
3. Rent, lease or purchase more *land,*
4. Obtain *off-farm employment,*
5. Leave the farm and *migrate* to urban areas or to better rural areas, and
6. Apply for public assistance.

Numerous studies in Tennessee and throughout the United States have been undertaken to describe and analyze the low-income problem facing farm firms, both large as well as limited resource farms. Coltrane and Baum (1965), when noting the insufficient resources controlled by Appalachian farmers, went ahead to suggest that this was a major factor contributing to the disparity between incomes of farms in the Applachian region and farmers in the rest of the U.S.

Land consolidation, migration and off-farm employment have been explored as viable adjustments for the Upper East Tennessee agricultural sectors. These possibilities, although perhaps effective means for increasing income, represent dynamic changes in the nature of East Tennessee agriculture and social structure. Alternative adjustments, such as the employment of advanced technology and shifting farm enterprises to more profitable ones, have not been fully explored as adjustment alternatives for agricultural areas such as East Tennessee. Research suggests that the nature of agriculture in the mountainous study area is inadequately suited for the assimilation of present day labor-saving technology. The shifting of farm enterprises to higher return enterprises has shown somewhat more attractive prospects. Although this study will concern itself primarily with optimal enterprise combinations as an income increasing adjustment, the other alternatives just noted are worthy of consideration. The following is a brief review of selected research which has examined alternative adjustments available to the farm sector and their impact on improvement of farm income.

Adjustments in Technology

Coltrane and Baum (1965, p. 2) noted that

> . . . technological innovations have influenced strong structural changes in agriculture . . . [and that the] . . . lack of suitable land resources for agricultural production in much of Appalachia has prevented many farmers from adopting the innovations necessary to make this transition.

Stewart (1975) also concluded that the potneital increase in smallholder farm income for the mountainous study area of eastern Kentucky

was primarily a result of sources other than the adoption of technology-embodying inputs.

Although innovative advances have made the American agricultural economy one of the most efficient in the world, technology has also created economic pressure for increasing farm size. Between 1950 and 1974, all farms in the U.S. had increased their size by 80% while Tennessee and the 12 county study area had increased their average farm size by 75% and 29%, respectively (*U.S. Census of Agriculture*, 1974 and 1950). This lag in the increase of farm size appears to suggest that the nature and characteristics of agriculture in the study area precludes the ability of low-income farm operators to expand their farming operations in order to accomodate the use of increased technology-embodying inputs.

Adjustment in Land Resources

Southeastern agriculture is generally characterized as being low in productivity and yielding a low per farm return when compared with other areas in the U.S. (Mitchell, 1968). Consequently, considerable research has gone into this area. Concerted research efforts of many predominantly southern agriculture experiment stations were made in the mid-1960's assessing the problem of minimum land requirements necessary to attain specified net income levels.[2] Studies under Regional Research Project S-42, "An Economic Appraisal of Farming

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[2]The Regional Research Project S-42 was a cooperative effort by the Department of Agricultural Economics of the following state agricultural experiment stations: Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

Adjustment Opportunities in the Southern Region to Meet Changing Conditions," generally attempted to hold net income at specified levels and to vary resources, particularly land, and product prices necessary to achieve the desired income level. A brief summarization of the project's findings follows.

Lanham and Coutu (1964) reported that for farmers situated in the northeast corner of North Carolina to reach a minimum net income level ($4,500), the number of farms would have to be decreased by 45%. The nine county area was characterized by an average farm size of 103 acres with the major enterprises being peanuts, tobacco, and cotton.

A similar study at the Oklahoma State University (Strickland, Plaxico, and Lagrone, 1963) concluded that 80% of the farms within the study area (southwestern Oklahoma) were too small, even with efficient operations, to give a minimum return to operator and management of $3,000. Furthermore, if consolidation of land were permitted in the model, the number of farms in the area would be reduced by 50% in order for the operator to realize a $3,000 income.

Studies in 1965 under the same regional project by the University of Georgia also revealed that definite adjustments were necessary if farm operators were to realize increased incomes. One hundred and ninety-five acres were required for a farm operator to make a $5,000 net return on his labor and management for the base situation (Amick and Allison, 1965). Of the enterprises included in the Georgia Piedmont area -- cotton, corn, wheat, oats, sorghum, soybeans, beef, and

hogs -- only cotton, soybeans, and beef entered the optimum farm plan.

Atkinson (1966) in this study for the Brown Soil Area of West Tennessee found that the land requirements ranged widely between 168 acres and 1,663 acres for a minimum of $5,000 net income. The average farm size during the study for the area was only 96 acres.

Eagen (1966) also reported that

> . . . considerable evidence exists that many farms in Tennessee . . . are so small as to preclude the attainment of adequate net earnings in spite of management and optimal enterprise organization. For these operators the addition of land, through purchase of rental, offers a main avenue of adjustment.

Whatley, Goddard, and Lard (1969) estimated that tenant farmers on the Ames Plantation had the potential to increase their net incomes by $6,398 over an 11 year period. The farm size of particular tenant farm operators, however, increased from an average of 83 acres in 1957 to 222 in 1968. The increased farm size combined with technological improvements such as mechanized cotton harvesting, adoption of chemical weed control and a shift from two- to four-row equipment, were major factors contributing to the increased net incomes. The improvement of enterprise mix with a given technology was not mentioned as a major contribution to profit maximization.

Coyle (1966, p. 93) concluded that for the Upper East Tennessee area, increasing industrialization with subsequently increasing land values and land scarcity has created an atmosphere for even greater land fragmentation. He felt, therefore, that "there is little reason to believe that consolidation of farmland in the region will be an attractive income adjustment alternative to very many farmers in the years to come."

Adjustments in Labor (Migration and Off-Farm Employment)

Changes in agriculture have created a steady migration out of rural areas. Migration has left a disproportionate number of older people relative to young adults in many areas (Galloway, 1945). Often only the youngest, best educated and most able individuals benefit from the out-migration process. Many of those migrating "have inadequate education and training for non-farm jobs . . . (Consequently, they acquire low paying jobs) and have greatest difficulty in rising to better jobs and higher incomes" (Marshall, 1974, p. 22). The President's National Advisory Commission on Rural Poverty (1967, p. 45) concluded that "migration to a city is, therefore, no guarantee of escaping poverty." There is also evidence that those who do migrate tend to be "the best educated, most adaptable portion of the rural population" (Marshall, 1974, p. 23), which again highlights the failure of the adjustment process to benefit some of those least capable of competing to make satisfactory incomes in modern agriculture.

The apparent decline in both the quantity and quality of labor from rural areas gives rise to the question of whether the remaining labor supply has the capacity of managing the freed land resources for agricultural use resulting from the out-migration. On this problem, Pavlick (1964, p. 5) concluded that:

> Analyses of land resources in West Virginia and human resources on West Virginia farms suggests that there is little prospect for small Appalachian farmers to achieve satisfactory incomes from farming because small farms cannot be enlarged to commercial size. . . . More than one-half of the low-income farmers on small farms could not meet the labor requirement of a commercial farm because of old age or other disability. The remainder were not willing to consider farm enlargement.

Henderson (1963) concluded that there has been a selective migration of educated youths from farm employment in Upper East Tennesses areas to nonfarm jobs. This migration, Henderson concluded, not only left the remaining labor in the area comprising the agricultural sector relatively less educated and older than the nonfarm labor supply, but kept farm assets low through the export of capital via migration of educated children.

Another study by Singer and Charleton (1971), however, found that of the population sampled, only one-third of all farm operators reported were over 65 years of age. The remainder of the operators seemed both capable of and engaged in full-time farming activities in the Arkansas Ozarks study area.

The President's Commission on Rural Poverty (1967, p. 141) concluded in their 1967 report that "farm operator families without the skills or resources to keep pace in the farm technological race, and without offsetting nonfarm job opportunities, comprise a large part of the poverty problem." Some of these families continue to farm and remain in the groups with low net incomes. The adjustment process has failed to benefit these people; the new technology and increased labor-saving mechanization have worked to their disadvantage. Research indicates that it is unlikely that these individuals could find nonfarm employment that would substantially raise their income levels (Hathaway, 1963).

Garrett (1976), however, noted that part-time farming supplemented by off-farm employment in the region of Upper East Tennessee ". . . has grown in significance to include a large percentage of

the farm population . . . and will continue to grow." He also noted that as land values increase, more farm operators may discontinue farming activities, altogether indicating out-migration or commuting to urban areas as adjustment alternatives.

Adjustments in Capital

A report by the Government Printing Office (1975, p. 2) concluded that "the principle cause of concentrations of farm people with low earnings has been found to be the inadequate agricultural resources in certain areas rather than the lack . . . [of management capability] . . . in the people themselves." This statement would appear to be especially applicable to the low farm income situation facing the Appalachian area of East Tennessee.

Money capital as well as the capital in land, buildings, and machinery has traditionally been such a limiting resource. Brewster (1957) estimated that the capital investment required for a farm operator to realize a $2,500 minimum net income level ranged from $14,000 upward to $89,000 in a study of six types of farms in major regions of the U.S.

Stewart (1975, p. 69), exploring the hypothesis of nonland capital as a constraining resource in eastern Kentucky, reached a somewhat opposing conclusion. He found that "when capital is limited . . . the income sacrificed is not as large as might be expected."

Adjustments in Management

Management, although not as easily quantifiable as land, labor and capital in ascertaining the net income potential for farm firms

is a very real input into a farming operation and, therefore, deserves attention.

A study by Schneeberger and West (1972) in Missouri revealed that net incomes of area farmers could be improved by an average of $490 over a four year period. This improvement would require an increase in the management input by the use of both professionals and para-professionals. Orden (1977) used a "Management Practices Index" computed on the basis of each farm operator's adoption of recommended management practices. The study covering the Floyd and Brunswick counties of Virginia revealed that most smallholder farmers in the study group used about half the practices relevant to their farm enterprise. Use of recommended practices was found to be significantly and positively related to the volume of farm sales.

A study of small farms in Wisconsin (Wilcox, 1946) indicated that the primary difference between high- and low-income farmers appeared to be in the quality of management skill, since the other resources available to both groups were similar. Hughes (1956, p. 39) reached a similar conclusion. He stated that in many areas of the South, even if farms were larger and other resources were available to low-income operators, they would not achieve higher incomes. People with poverty backgrounds Hughes concluded, ". . . do not seem to be motivated and/or able to acquire, analyze, and organize available knowledge and resources so as to earn much higher incomes." Tweeten (1968, p. 43) also concluded in his study of rural poverty that ". . . even with reasonable help with credit and management, most farms in depressed areas cannot become economic units."

The increase in the incomes of low-income farm families as a result of adjustments mentioned -- upgrading technology, acquisition of additional land, migration from rural areas, obtaining off-farm employment, obtaining additional capital and increasing the managerial capacity of a farm operation -- has not potentially come about directly from adding another unit of resource or implementing the required status changes. Underlying all the adjustment alternatives is the implication that the change in income position has been brought about through a more efficient use of opportunities and resources to produce enterprise changes. Increasing farm income by combining resources in an optimal manner, which is the primary focus of this study, appears to represent an important adjustment in East Tennessee agriculture.

Adjustments via Enterprise Shifts

Southeastern agriculture is not homogeneous in terms of income changes (Mitchell, 1968). Between 1954 and 1964, Tennessee showed a pronounced lag in the rate at which average net income increased when compared to other southeastern states. This lag was due in part to a relatively slow shift to those enterprises that were experiencing rapid increases in returns per man hour. Instead, there was a tendency towards increased production of those enterprises that experienced the smallest increase in returns per man hour and which were not correlated to income increases. Tobacco and dairy enterprises which are characteristic of the typical farm in Upper East Tennessee were among those enterprises lagging in growth of returns per man hour. It was indicated that tobacco, a major enterprise of the farm operators in

the study area, had not experienced the labor-saving technology of other crops which may act as an inhibitor to expansion of farm size and farm enterprise.

Gerlow (1970) made use of two tenure systems, five crop alternatives, one livestock enterprise, and seasonal labor in determining the resource adjustments necessary to maximize incomes on farms in the Southwest Louisiana rice area. Gerlow found that seasonal labor generally resulted in increased net incomes, as well as the substitution of row crops (cotton, sweetpotatoes, and soybeans) for pasture, since returns from beef cattle were relatively low.

A similar study in Louisiana by Woolf (1961) reported that, in general, farm incomes were increased by over 50% when technology and management were raised to advanced levels on small farms in the Mississippi Delta area. Cotton, soybeans, and wheat entered the optimum farm plan at the assumed levels of technology. When dairying and commercial layers were allowed to enter, net income increased by over 300% with layers being the better suited for smaller farms. Stewart (1975, p. 58) concluded that ". . . even if operators are not able to increase the size of their land resources, they can still improve their incomes by a more optimal selection of enterprises . . ." Using capital as a constraint, Stewart reported that crop rather than livestock enterprises should be emphasized.

Thus, there is evidence for and against the existence of a potential for increasing incomes in the poorer, marginal agricultural areas of the U.S. Tweeten (1968), as noted earlier, felt that farms

in depressed areas could not become economic units. Likewise, Bondurant (1953, p. 43), in a study of the effects of land quality on farm incomes in eastern Kentucky concluded ". . . it would appear that relatively low incomes from farming may be expected in the poorer, less productive areas as long as they are used for farming purposes."

The nation has expressed its concern for the poorer segment of society through its "War on Poverty" program, as well as others. The type of agricultural policies and programs which tend to have the greatest impact on the farm segment of the agricultural population depends largely on the existing resource use practiced among these farm operators.

This study examines the alternative adjustment of shifting farm enterprises from low return to higher return enterprises. The examination is based on the hypothesis that a reallocation of the resources presently available to farm operators in Upper East Tennessee may result in an optimal enterprise mix that will increase net income.

CHAPTER II

AN HISTORICAL FRAMEWORK

The portion of the southern Appalachian region comprising the 12 county study area includes slightly over 2.5 million acres. Almost half this acreage makes up the 17.3 thousand farms in the region.

I. SOILS

Two general soil groups can be found in Tennessee: the grey-brown podzoid soils, a comparatively less acidic, less leached, high organic soil found in the study area; and the red and yellow soils in other areas of the state. Soil fertility varies according to the parent material from which it evolved. Sandstone and shale as well as limestone are the parent materials associated with the study area. Limestone parent material, prevalent in the northern portion of Upper East Tennessee, represents the best soils of the region.

According to the 1967 soil inventory data collected by the Soil Conservation Service (USDA, 1971), 27% of the inventory acreage[3] in the Upper East Tennessee region falls into Classes I-III soils. This comprises 44% of inventory land for the state, classified as Class I, II, and III soils. These data were developed from information

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[3]"Inventory acreage" is the area that remains after federal land, urban and built-up areas, and water areas are subtracted from the total land area of a county (USDA, 1971, p. 121).

on smaple area plots for soil, slope, erosion, and other land conditions. The categorization of soil classes are identified in Appendix A. Clearly the agricultural capability of soils in the study area is less than that of the state as a whole.

II. TOPOGRAPHIC FEATURES

The 1,300 mile expanse of the Appalachian mountains passes through the eastern portion of Tennessee and the study area. Each portion of the mountain chain has been given a name. Unaka, being one such name, represents the Tennessee protion of the chain. Other smaller ranges, including the Bays, Clinch, and Holston formations, are also included in the area. Together, this mountainous topography of Upper East Tennessee was aptly described 100 years ago as ". . . its surface presents the appearance of an extended and congealed billowy sea, the great wave of which succeed each other in parallel lines" (Killebrew, 1874, p. 529). Topographic features of the study area combined with a comparative deficiency with the rest of Tennessee of Class I and II soils limits severely the production of crops requiring extensive cultivation.

III. ECONOMY

The economic conditions existing in Upper East Tennessee are largely the result of former economic activities. Prior to the Civil War, manufacturing was essentially nonexistent. The economic development of Tennessee could not have occurred without a series of adjustments accomodating changing conditions. Since the 1800's, cottage

industries have gradually given way to a more complex form of industrial expansion. The increased use of the region's natural resources and the transformation of labor used for subsistence agriculture to manufacturing accompanied industrialization. Garrett (1976) noted that industrial expansion in the study area continued since the mid-1800's. The per capita value added by manufacturing in the area surpassed that of the State in 1929 and of the U.S. in 1963.

Regional industrialization has provided additional off-farm employment opportunities for area farmers wishing to supplement their incomes. The U.S. Department of Commerce statistics reveal that between 1950 and 1970 nonfarm income in the region increased 344% while the population grew 305% (Garrett, 1976).

The agricultural sector has not experienced the growth pattern of the industrial sector. The early 1900's continued to have a large portion of the population involved in the agricultural sector. This proportion began a decline during the depression and continued until 1950 when agriculture lost its status as the leading industry in the state (Freeman, 1965).

Net farm income, in fact, experienced a decline of 14% during the 1950-1970 time period. Whereas farm income made up 16% of total income in 1950 from the agricultural and industrial sectors, it comprised only 3.5% in 1970. Limited adjustments to these changing conditions have consequently left a high proportion of farms with low gross sales in Upper East Tennessee. According to the *U.S. Census of Agriculture,* 1974, 82% of all farms in Tennessee had gross sales of less than $10,000. The proportion of farms with low sales are

even higher in the mountainous eastern region of the state where more than 90% of all farms fall within the low-income category.

"The average size of farms in . . . [Cocke] County, as in all counties of East Tennessee, is, by far, too large . . ." reported Killebrew (1874, p. 485) more than 100 years ago. This statement points to the changes in land consolidation that have occurred in the region over the past 100 years. Following the Civil War the average farm size in Tennessee decreased from 261 acres to 73 acres in 1930 (Freeman, 1965) after which the decline was reversed and climbed to 140 acres in 1974. During the period between 1950 and 1974 Tennessee increased its farm size by 75% while farm size in Upper East Tennessee increased by only 29%. The present size of farms in Upper East Tennesses averaged 74 acres, less than one-fifth the national average (*U.S. Census of Agriculture*, 1974).

Recent increases in farm size have necessarily been accompanied by decreases in the number of farms. Between 1959 and 1974, the number of farms in the state decreased 41% while the number in the study area declined by 34%. Although the study area comprises only 10% of all farmland in the state, 18% of the farm operators were located in Upper East Tennessee (*U.S. Census of Agriculture*, 1974).

Of special relevance to this study is the adjustment East Tennessee has undergone in its agricultural production. Killebrew (1874) noted that ". . . East Tennessee has long produced too much [corn, and that] . . . oats are much a complementary enterprise with swine production." He went on to remark that

> If the country can ever get rid of the thousands and tens of thousands of worthless dogs . . . the rearing of sheep will

> soon thereafter become one of the leading and most profitable branches of rural economy in East Tennessee. Yet, in Tennessee the dog, the most worthless, vilest, meanest of the inferior animal creation is allowed . . . to continue his ravages . . ."

Eighty-five years later, Henderson (1960) summarized resource adjustment as tobacco replacing grain as a cash crop and cattle replacing hogs -- an enterprise combination that fairly well characterizes East Tennessee agriculture today.

Table 2 summarizes the composition of farmland by crop for the study region and for Tennessee. The basic difference in the Upper East Tennessee area and the state is the amount of cropland that is harvested. While almost 50% of the cropland in Tennessee was harvested in 1974 -- mostly from soybeans (36%), hay (27%), corn (14%), and cotton (13%) -- less than one-third of the cropland in the 12 county area was classified as harvested.

This 1974 data varies significantly from the previous data which indicated that nearly half of all cropland in the study area was harvested in 1959. Hay (63%), corn (22%), and tobacco (6%) made up the bulk of the crop acreage in the region in 1974. It is evident that these cropping patterns are substantially different from that of Tennessee. The composition also indicates significant shifts of enterprises in the region since 1959. Hay and pasture comprised a smaller portion of the cropland in the past -- 72% in 1959 and 82% in 1974. Small grains, wheat and oats, were more important in 1959, when they comprised 16% of the cropland harvested, than they were in 1974, when they made up only 3% of the cropland acreage harvested.

Data in Table 3, which shows the contribution to total income

TABLE 2. Composition of Farmland and Selected Crop Acreage for All Farms in Upper East Tennessee and Tennessee, 1959 and 1974

Classification	Upper East Tennessee		Tennessee	
	1974	1959	1974	1959
	Acres			
Farmland:				
Cropland:	720,645	808,766	7,756,516	8,499,211
Harvested	225,741	367,673	3,746,117	4,119,418
Pasture	430,411	376,110	3,500,924	3,216,771
Other	64,983	64,493	509,478	1,166,022
Woodland	321,051	424,321	3,410,625	5,201,315
Other	232,644	314,465	1,936,083	2,380,759
Pasture	102,733	232,547	1,275,743	1,484,776
Selected Crop Acreage:				
Corn (for grain)	56,941	89,434	559,408	1,416,688
Sorghum	1,161	3,126	39,404	69,811
Soybeans	2,390	4,144	1,401,705	432,791
Wheat	8,301	47,420	241,891	156,766
Oats	a	16,798	a	126,210
Hay	160,558	210,022	1,052,796	1,189,575
Tobacco	16,206	20,498	49,489	74,216
Potatoes	781	793	3,450	5,838
Vegetables	1,738	5,486	29,643	44,000
Small grain	2,954	a	23,176	a
Cotton	0	0	497,362	510,135
Other	3,100	3,852	41,310	93,388
TOTAL[b]	254,130	401,573	3,939,634	4,119,418

[a]Not classified.

[b]Because of some crops destroyed or otherwise left unharvested, the total of selected crop acreages may not equal acres of cropland harvested.

Source: U.S. Department of Commerce, Bureau of the Census. *U.S. Census of Agriculture, 1974* and *1959*. Area Reports, Tennessee, U.S. Government Printing Office.

TABLE 3. Sales of All Agricultural Products From Commercial Farms in Upper East Tennessee and From Commercial Farms in Tennessee, 1974

Crop Classification	Upper East Tennessee (1974)		Tennessee (1974)	
	$000 Sales	Percentage Contribution[a]	$000 Sales	Percentage Contribution[a]
Crops and Hay:	33,333	37.6	407,213	48.1
Grain	3,294	3.7	233,713	27.6
Tobacco	25,055	28.2	75,862	8.0
Cotton	0	0.0	61,294	7.2
Seed, hay, forage, and silage	3,187	3.6	19,990	2.4
Other (field crops)	346	0.4	2,894	0.3
Vegetable	1,058		11,309	1.3
Fruit	394	0.4	2,151	0.3
Livestock:	55,403	62.4	438,966	51.9
Poultry	5,322	6.0	73,476	8.7
Dairy	28,070	31.6	142,092	16.8
Beef	20,063	22.6	149,064	17.6
Hog	1,400	1.6	68,962	0.1
Sheep	77	0.1	498	0.1
Other	471	0.5	4,938	0.6
Forest Products	360		6,129	
Nursery Products	1,276		21,884	
Total Value of Sales	90,362		874,192	

[a]Percentage of crop, hay, and livestock sales.

Source: U.S. Department of Commerce, Bureau of the Census. *U.S. Census of Agriculture, 1974.* Area Reports, Tennessee, U.S. Government Printing Office.

of various enterprises, further accentuates basic differences between the region and state. The contribution to gross income by major enterprise is, in order of importance, dairy (32%), beef (23%), and tobacco (28%) for Upper East Tennessee and grain (28%), beef (18%), and dairy (17%) for the state.

The classification of farms by crop is also useful in characterizing agriculture in Upper East Tennessee. Of the 7,775 farm operators in the study area having gross sales of $2,500 or more during 1976, the crop enterprises produced and the proportion of the area farmed producing the crops are given below.

Crop	Proportion of Area Commercial Farmers Producing Major Crop Enterprises (%)
Grain corn	43
Corn silage	15
Wheat	8
Sorghum	1
Soybeans	1
Tobacco	90
Hay	72
Potato	9
Vegetables/melons	4
Nursery products	7

The farmers surveyed owned an average of 61 acres of farmland other than timber or waste of which 48 acres were cropland and the remainder permanent pasture. The most important use of farmland was for pasture, which comprised 59% of land use for agriculture (Table 4). The composition of the remaining cropland -- mostly hay, corn and tobacco -- was similar to that of other farmers in the region.

Important differences in income composition, however, were evident. Whereas tobacco was the third largest contributor to income

TABLE 4. Total Gross Farm Sales and Acreages, by Crop, for 40 Farm Operators Surveyed in Upper East Tennessee, 1976

Enterprise	Gross Sales		Enterprise Combination (Acres/Animal Unit)			
	Dollars	Percentage[a]	Own	Rent-In	Rent-Out	Percentage[b]
Crops:	190,004	48.9	2,406.2	555	40.3	100.0
Tobacco	165,619	42.6	48.8	11	8.3	2.3
Corn (grain)	6,355	1.6	78.8	129	32.0	8.0
Corn (silage)	0	0.0	126.0	60		6.2
Wheat	2,050	0.5	23.0	20		1.4
Oats	806	0.7	2.0	13		0.5
Hay	2,510	1.3	588.0	91		22.6
Pasture on cropland	0	0.0	1,001.0	91		36.4
Permanent pasture	0	0.0	531.0	140		22.4
Vegetables:						
Tomato	5,000	0.5	2.5			0.1
Snap bean	5,150	1.3	3.8			0.1
Potato	504	0.1	0.5			
Melons	2,000	0.2	1.2			
Livestock:	198,766	51.1				
Dairy	118,450	30.5	192.0			
(Cow sales)	8,414	2.2				
Beef	59,842	15.4	580.0			
Swine	1,760	0.5	6.0			
Poultry	10,300	2.7	100.0[c]			

[a]Percentage of total crop and livestock sales.

[b]Percentage of total crop acreage.

[c]Thousand bird units.

Source: Survey of 40 Farmers in Upper East Tennessee, 1977.

for farmers in the region (28%), it was the most important income source (43%) for the limited resource farmers surveyed. Income from beef surprisingly accounted for a smaller proportion of total income (15%) for the limited resource farmers than for all area farmers (23%). This can be partially explained by the low 1976 beef prices which had the effect of lower income from beef sales, relative to the 1974 sales of area farmers with which it is compared. The pricing situation also encouraged farmers to delay some sales until 1977.

CHAPTER III

ANALYTICAL FRAMEWORK

I. PROGRAMMING MODEL

The general objective of this study was to develop an analytical framework which could be used to estimate the potential income effects of optimal enterprise combinations on Upper East Tennessee farms of low-income farmers. Linear programming was the analytical technique considered to be most appropriate since it is capable of generating solutions for all relevant cropping and resource set combinations by estimating which of the farmer's resources are most limiting.

Linear programming is a mathematical technique which deals with the problem of allocating limited resources among competing activities in the best possible (optimal) way. The variety of situations to which this tool applies is diverse, ranging, for example, from the allocation of production facilities to products, to the allocation of national resources to domestic needs, and from the composition of animal feed with certain minimum nutritional requirements to the selection of shipping patterns. The one common component in each situation is the need to optimally allocate resources to activities. In this study, the profitability of the farm firm is the objective, such that each mix of the available resources of a firm is the result of the operator's goal, that is, to maximize net income. This maximization is subject to the constraints imposed by the availability of resources required to produce the products and constraints imposed

by assumed enterprise preferences. Stated mathematically, the linear program model is as follows:

maximize the objective function: $Z = c_1x_1 + c_2x_2 + \ldots + c_nx_n$

subject to the constraints:

$$a_{11}x_1 + a_{12}x_2 + \ldots + a_{1n}x_n \leq b_1$$

$$a_{21}x_1 + a_{22}x_2 + \ldots + a_{2n}x_n \leq b_2$$

$$a_{m1}x_1 + a_{m2}x_2 + \ldots + a_{m2}x_n \leq b_m$$

and: $x_1, x_2, \ldots, x_n \geq 0$

where: Z = profit or net income of the farm firm;

n = the number of possible enterprises;

m = the number of resource restrictions;

parameters
- c = profit for each unit of enterprises 1,2,...,n;
- b = the maximum level of resources 1,2,...,m;
- a = requirement of the resources 1,2,...,m for the enterprise 1,2,...,n;

decision variable: x = the level of the enterprises1,2,....n.

Net income or profit maximization, assigned as the sole objective of a farm operation, will not, in reality, fully explain the behavior of a particular farm manager. It does, however, provide in a convenient and concise manner a way in which income potential can be assessed. Values and goals of farm families interact with income possibilities from any one set of enterprises to influence the actual behavior of a farm manager. Although these values and goals cannot be directly translated into accurate monetary terms, certain restrictions can be introduced into the linear program to more closely approximate the potential for increased net income within this framework of values and goals.

All input-output relationships in a linear programming model have been assumed, as the name implies, to be linear. The input coefficients, the parameters, are therefore constant. This assumption weakens the results of a linear program solution if relationships are something other than linear. However, this source of error can be kept at an acceptance level by treating different enterprise levels as separate activities. Cautious interpretation of the results should be made because of the linearity assumption.

Multiple objective functions, that is multiple enterprise returns, representing varying associated yields, prices, or costs or any combination of these, may be employed in order to obtain solutions resulting from alternative conditions. Linear programming also provides the advantage of a "dual solution," the values of which are termed shadow prices of the associated resources. These shadow prices indicate the amount by which the objective function would be increased if an additional unit of resource -- an acre of land or an hour of labor, for instance -- were employed. Additionally the range over which price and enterprise levels in the optimal solution can change before a new solution will occur may be computed. Linear programming's characteristics of flexibility as well as implicit pricing render it a suitable and convenient tool for the study of small farm income potential.

II. BASIC MODEL

A general matrix -- or set of input-output coefficients -- was constructed for the study as the basis for formulating optimal solutions (Appendix B). Adjustments in the levels of individual farm firm

resources, input-output coefficient changes, and the exclusion of selected enterprise vectors could be conveniently undertaken to determine income changes resulting under alternative conditions.

Two major categories of the linear program included: (a) limiting the allowable enterprises making up the optimal solution on a particular farm to those observed on that farm at the time the survey was taken, and (b) allowing all enterprises observed in the survey area, with the exclusion of some specialty enterprises, to freely enter into the optimal solutions of individual farm firms. A further subdivision of these two categories was made. The enterprise mix, which maximized net income, was also considered a function of (a) short-term conditions, and (b) long-term conditions. Variable expenses only were included in the objective function when the short-run was considered. Variable and fixed expenses were included in long-run situations. Additional conditions were imposed within these subcategories and will be reviewed later in the study.

III. BASIS FOR ANALYTICAL EVALUATION

Preliminary analysis suggested that the aggregation of individual farm firm resources into homogeneous resource groups and then solving for the optimal enterprise combination would not reflect the potential income for the average farm. Such an aggregation would, for instance, enable one farm with relatively limited labor resources to borrow from another possessing relatively abundant labor. These aggregated resources would be used to determine the optimal enterprise combination and the maximum net income of a farm -- a net income which could be characterized as somewhat excessive and inflated.

Farms were categorized into four homogeneous groups based on resources available and on the observed and estimated net incomes from these farms. The resource mix, enterprise combination and net income solution of each farm was then averaged within the appropriate group. The decision variables used for grouping the 40 farms analyzed were:

1. land-labor index
2. tobacco space
3. dairy enterprise potential
4. net income observed for each farm
5. net income that could have been realized had the operator allocated his resources in the most efficient manner possible to maximize income, given enterprises observed for each farm firm

The first three variables represented the major resources which would determine the actual homogeneity of farm firms for grouping purposes. The latter two were included in order to incorporate farm operator preferences and goals, again, for grouping purposes.

The first variable used in the grouping criteria was derived by combining two important and substitutable resource inputs, land and labor, into a common index. In order to account for one farmer having relatively more land resources and fewer labor resources than another, a multiple (rather than a ratio) of these two inputs was calculated as the basis for the index, that is, land units x labor = land-labor index. Labor was measured as annual hours of family labor available for farm work. Land was measured as units with acreage under various

tenure arrangements given the following weights:

1 acre of cropland owned and farmed = 1 unit

1 acre of permanent pasture land owned and farmed = 0.5 unit

1 acre of cropland owned and rented-out = 0.5 unit

1 acre of cropland rented-in = 0.5 unit

1 acre of permanent pasture land rented-in = 0.25 unit

Doubling the rented land requirement to make up a land unit was an attempt to quantify the income potential forgone by not receiving the full production benefits (income) resulting from the production of an acre of land owned and farmed. Likewise, requiring two acres of permanent pasture land to equal an acre of cropland was an attempt to quantify different productive capacities of land. If, for example, a particular farm operator owned and farmed 50 acres of cropland as well as 50 acres of permanent pasture, and had available 2,000 hours of labor annually, his particular land-labor index would be: (75 land units) x (2,000 hours) = 150,000 (index).

The second variable, tobacco space index, was considered in such a way that each pound of tobacco barn space owned was equal to one index unit. In the case that tobacco acreage was rented-in or out, each pound of tobacco produced on this rented land was equal to half a unit of tobacco space index since the income received in this case is roughly half that (assuming a 50/50 rental arrangement) of a pound of tobacco on owned land. Each pound of tobacco quota leased out was, in a like manner, equivalent to half a unit of tobacco space index. For example, a farmer owning a 5,000 pound capacity tobacco barn and renting-in one acre (2,400 pounds) of tobacco would be credited with a 6,200 unit index.

The dairy enterprise potential considered only those farms having an existing dairy operation. All other farm operators were assumed to lack either the preference and/or managerial capacity required for the dairy enterprise. Proper dairying facilities were nonexistent on these farms and allowing new dairies to enter these farm solutions appeared to be an unrealistic assumption.

The remaining two variables used for grouping farms were converted to indexes which attempted to measure the income maximization goal of a farmer. An operator may own considerable resources but, because of conflicting goals, he utilizes them in such a way that profit is not maximized. Observed net income is the income derived when observed enterprise levels were forced into the linear programming model. The other income-related decision variable was net income potential from optimizing resources in the short-run. This profit maximization solution constrained farmers to enterprises they had previously produced.

Categorizing a farm within a particular decision variable -- land/labor, tobacco space, dairy potential, observed income, and potential income -- was represented by five or six delineations, depending on the variable and are shown in Appendix Table C-1. Each delineated portion of the decision variables included a + or - area (weighted as +0.5 or -0.5) which further stratified the farms by indicating whether a given farm fell near the top or bottom quarter of a category. Using the tobacco space variable as an example, assume that a farmer had available 5,100 units (pounds) of space. He would be assigned a 3-

index for this particular variable. Another farmer having 5,800 units would be assigned an index of 3.

The category index values of each decision variable for each farm were then added to obtain a composite index representing each farm (Appendix Table C-2). Groups were then formed on the basis of this composite index by categorizing farms as:

Group 1 = Composite index 2.0 - 6.5

Group 2 = Composite index 7.0 - 12.0

Group 3 = Composite index 13.5 - 17.0

Group 4 = Composite index 17.5 - 29.0

Appendix Table C-3 indicates the grouping of farms as well as the quantity of resources and income-making ability used in determining the farm groups. These indexes were divided into four groups, Group 1 of which included farms with relatively limited resources and Group 4 which included farms possessing the most resources within the study group.

IV. RESOURCE AVAILABILITY AND ASSUMPTIONS

The income potential for any single farm is determined largely by the resources available to the farm, the ability of management, and the willingness of the farm operator to engage in enterprises which maximize profit. Survey questions were carefully constructed to reflect accurately these critical elements of the model. Owned resources -- land, labor, tobacco space, hay space, and machinery and equipment -- as well as rented resources were the major quantifiable resources.

The resources available are broken down by farms and averaged by groups in Appendix D.

Land

Land is characterisically scarce for small farms within the study area. Land was classified as: (a) bottom land, (b) rotation land, (c) permanent pasture land, (d) woodland, and (e) waste land. Bottom land and rotation land are the classifications comprising the total cropland. Bottom land could accomodate all row and hay crops and pasture. Rotation land was capable of supporting the same crops as the bottom land, but with lower yields. Permanent pasture land, that which could not be tilled as row crops or hay, could be seeded and used as pasture but with a lower total digestible nutrient (TDN) yield than the pasture on rotation land. Neither woodland nor waste land could be used as a resource for enterprises included in this study. Woodland, although a potential income generating resource for farms when properly managed, was not included as an enterprise possibility because it is not a conventional enterprise in East Tennessee.

Land available for rent (either in or out) was limited to those farms where renting was reported in 1976. In order to better reflect prevailing conditions in the area, rented acreage was limited to the amount reported by the operator. Land capability classification on rented acreage was the same as for owned land. Sixty percent of all farm operators surveyed reported that no land was available for rent within two miles of their operation during the three year period prior to the survey. Of the 40% reporting land available for rent within a

three mile radius, only a fourth of them had any interest in renting the land. The assumption of limiting land rental to those farms observed renting land has been incorporated into the model to reflect the limited opportunities, both existing and potential, for expanding land resources.

The average size of the farms surveyed in the area was 85 acres, of which 48 acres were cropland. Most of this cropland (81%) was used in the production of pasture or hay. The average farm also consisted of 13 acres of pasture on noncropland (permanent pasture). The remaining 24 acres was in woodland and waste land.

Cropland acreage, by group, ranged from 18.5 acres cropland for farms in Group 1 to 94.0 acres for those in Group 4, the dairy farm group. Average land resources available in each farm group are summarized below.

	Land Resource Availability (Acres)			
	Own		Rent	
Group	Cropland*	Permanent Pasture	Cropland*	Permanent Pasture
1	18.5	8.5	2.0	2.5
2	55.2	15.5	6.8	0.0
3	40.0	15.5	26.2	7.6
4	94.0	15.0	18.0	8.0

*Bottom land and rotation land are both included under the general heading of "Cropland." Acreage in woodland and waste land are not shown.

Labor

Labor available to each farm was divided into two-month periods. A full-time worker was considered as one who had 520 man-hours available for work during a two-month period (60 hours per week). On an

annual basis, 2,340 man-hours were permitted for each full-time worker (75% of the total two-month labor or 45 hours per week). This allowed a farm operator to borrow additional labor from marginally unproductive time periods for use during periods where the productivity of labor was greater. Family labor, other than labor of the operator, characteristically the wife, children living at home, and sons who returned home during peak labor-requirement periods, was determined for each two-month period and the total determined the same way it was for full-time workers. All labor was assumed to be homogeneous.

Labor was not allowed to enter the model as hired in or out except hired labor for custom harvesting. Although 60% of all farm operators surveyed reported having hired labor in 1976, the total amount hired represented only 7% of the total labor used and this was mostly for custom harvesting. Additionaly justification for the hired labor restriction was that only 8% of the farm operators indicated that seasonal labor was "usually available." The remaining 92% of the respondents indicated that (a) labor was seldom available during the peak season (53%), (b) labor was available only during the nonpeak period (13%), and (c) labor was not available at any time (26%).

Labor resources varied widely between the most and least limited resource farm groups. Labor availability for farms representing Group 1, for example, averaged 37 hours per week while multiple farm operators and family labor observed on certain farms contributed 80 hours of labor available to dairy farms. Labor resources for all the limited resource groups are summarized below.

Group	Labor Resource Availability (Man-Hours)			
	Peak Labor Period		Annual Labor	
	Period	Weekly*	Annual	Weekly*
1	435	(50)	1910	(37)
2	685	(79)	2915	(56)
3	996	(115)	3903	(75)
4	978	(113)	4136	(80)

*Labor comprising the two-month peak period and labor available annually have also been indicated as labor available on a weekly basis.

Hay, Tobacco, and Silage Resources

Barn space was defined in terms of bales of hay and/or pounds of tobacco capacity, depending on the type of storage facilities on a particular farm. When a farmer reported that barn capacity could be substituted to accomodate either hay or tobacco, the space was defined in terms of tobacco space. This assumption was supported in the preliminary analysis which suggested that barn capacity was marginally more productive when used for tobacco than when used for hay.

Silage enterprises were limited to those farms having appropriate silage facilities, either upright or, as in most cases, trench silos.

The average storage capacities for farms comprising the limited resource farm groups are shown below.

Group	Storage Capacity Resources		
	Tobacco (lbs)	Hay (bales)	Silage (tons)
1	2713	992	0
2	4171	2971	47
3	6843	2285	0
4	8857	2714	396

Each farm had a tobacco quota or quota base (defined as pounds of tobacco) which could be used in tobacco production or transferred

by leasing to another farm or farms within a given county. Production of tobacco in excess of the quota allocated to a particular farm would, likewise, require leasing poundage allotments from other farms within the county. Keller and Culver (1976) reported that because quota rental rates are determined competitively and separately for each county, the price at which tobacco quotas were leased in 1975 varied throughout Tennessee. The average rental rate in 1975 for which tobacco was leased within the study area, by county, varied from $.10 per pound in Carter County to $.27 in Hancock County. These price differentials have been incorporated into the linear programming matrix so that the tobacco quota rental rates would reflect the average lease price within a particular county. Lease prices for 1975 for each county within the study area are recorded in Appendix E.

Machinery and Equipment

Information pertaining to machinery and equipment accessible to each farm, either through owning, borrowing, or exchanging was obtained. Custom work performed on a farm was also noted. A summary of the equipment for the 40 farms surveyed is shown in Table 5. Most farmers owned at least one tractor while 35% owned more than one. It was observed that as farm groups increased their resource based (from Group 1 to Group 4), the number of tractors owned also increased. Whereas none of the farmers comprising Group 1 owned more than one tractor, more than half of the farmers in Group 4 owned at least two with nearly 30% owning four.

Most of the farm operators also owned the conventional attachments

TABLE 5. Equipment and Machinery Owned, by Limited Resource Farm Group, in Upper East Tennessee, 1976

Machine (Description)	Limited Resource Farm Group 1 (N=12)	2 (N=14)	3 (N=7)	4 (N=7)
Tractor 1 (percent)[a]	67	93	100	100
Horsepower	48	48	45	53
Year[b]	1955	1967	1965	1972
Tractor 2 (percent)	0	57	29	57
Horsepower	--	36	32	56
Year	--	1958	1962	1971
Tractor 3 (percent)	0	7	29	29
Horsepower	--	30	32	32
Year	--	1947	1958	1961
Tractor 4 (percent)	0	0	29	29
Horsepower	--	--	39	24
Year	--	--	1951	1955
Disk 1 (percent)	50	100	100	100
Width (feet)	10	9	7	9
Year	1960	1966	1972	1973
Disk 2 (percent)	0	21	14	14
Width (feet)	--	8	6	8
Year	--	1962	1962	1966
Plow 1 (percent)	67	100	86	100
No. of bottoms	1	2	2	3
Year	1963	1969	1970	1971
Plow 2 (percent)	0	14	57	29
No. of bottoms	--	2	2	3
Year	--	1965	1962	1967
Harrow (percent)	8	14	14	0
Year	1941	1955	1962	--
Planter 1 (percent)	8	71	57	86
No. of rows	1	2	2	2
Year	1955	1961	1971	1965
Planter 2 (percent)	0	14	14	0
No. of rows	--	2	2	--
Year	--	1963	1947	--

TABLE 5 (continued)

Machine (Description)	Limited Resource Farm Group 1 (N=12)	2 (N=14)	3 (N=7)	4 (N=7)
Tobacco Setter (percent)	17	79	86	86
Year	1966	1964	1972	1970
Drill (percent)	0	36	29	57
Year	--	1956	1964	1963
Field Cultivator 1 (percent)	67	86	71	86
Rows	1	1	1	1
Year	1961	1961	1969	1967
Field Cultivator 2 (percent)	0	0	14	29
Rows	--	--	2	1
Year	--	--	1950	1955
Combine (percent)	0	0	29	14
Year	--	--	1953	1959
Corn Picker (percent)	0	21	29	43
Rows	--	1	1	1
Year	--	1970	1954	1965
Hay Rake (percent)	25	79	71	57
Year	1969	1966	1972	1969
Hay Conditioner (percent)	0	21	0	14
Year	--	1963	--	1976
Hay Baler (percent)	25	50	57	86
Year	1962	1972	1972	1972
Silage Chopper (percent)	0	14	0	43
Year	--	1969	--	1969
Sickle Mower (percent)	58	79	86	86
Year	1962	1967	1967	1970
Bush Hog (percent)	0	29	43	29
Manure Spreader (percent)	8	50	43	100

TABLE 5 (continued)

Machine (Description)	Limited Resource Farm Group 1 (N=12)	2 (N=14)	3 (N=7)	4 (N=7)
Fertilizer Distributor (percent)	8	43	43	29
Subsoiler (percent)	17	7	29	14
Wagons/Trailers (percent)	17	79	71	100
Average No./Farm	1.0	1.7	1.8	2.0
Subsoiler (percent)	17	7	29	14

[a]Percentages refer to that portion of a group (N=100%) owning the indicated machine/equipment.

[b]Year refers to the average year in which the machinery/equipment was initially purchased.

Source: Survey of 40 Farmers in Upper East Tennessee, 1977.

such as plows, disks, and field cultivators. Although most farmers in the most limited resource group of farms raised tobacco, only 17% of these operators owned tobacco setters compared to 86% of the farmers in Groups 3 and 4. Almost half of all operators owned a hay baler. Other farmers having hay baled had it custom baled. It was also observed that, in general, as the resource based of a farm increased, the size and capacity of the machinery also increased while the age of the machinery decreased.

All enterprises requiring harvesting machinery or other special equipment (hay baler, corn picker, grain combine, forage chopper, and blower) were broken down in the input-output matrix between enterprises on farms where harvesting machinery was owned and enterprises requiring the use of custom harvesting. This breakdown became especially important for the hay enterprise. Based on estimated budgeted costs, variable costs per acre of hay for farmers who owned their baling equipment were approximately 50% less than those who were required to hire their baling done. This breakdown treated the hay enterprise, for example, as two different activities in order to portray more realistically the actual equipment situation. Farms observed to have fallen under one activity or the other were then assigned in either the "machinery owned" or "custom harvest" category for that enterprise throughout the linear programs.

V. ENTERPRISE RESTRICTIONS AND ASSUMPTIONS

Farmers in Upper East Tennessee included in the study produced a variety of enterprises. The most common were tobacco, beef, and dairy.

However, various specialty-type enterprises such as tomatoes, broilers, and snap beans were also observed. Individual farm plans were limited to the most common enterprises, unless otherwise indicated. Specialty-type enterprises were allowed to enter the plan on those farms where these enterprises had been observed.

Some farm operators were observed to be more efficient than others. That is, each farmer was operating on a unique production function. Individual enterprise budgets which incorporated these particular characteristics, although ideal in this type study, were not considered feasible. One budget for each activity, under which good management was assumed, was constructed for all farms. In some cases the expenses may be overstated or labor requirements understated due to the nature of the relatively small farms. For example, if a farmer did not fertilize his pasture, this cost was included in the budget but not actually incurred. Enterprise labor requirements are stated in Appendix F. Enterprise budgets are outlined in the tables of Appendix G.

Livestock feed requirements were divided into a concentrate and a roughage portion. The concentrate portion was assumed to have been met by purchased protein supplements and by grain which could be produced on the farm or purchased. The roughage portion was met by silage, hay and/or pasture. In some cases, minimum requirements for different type roughages were specified. Transfers of grain and roughage were expressed in terms of TDN. Transferring activities allowed feeds to be transferred from the period of the year in which they were produced to periods of the year in which they were fed. Transferring pasture

resulted in a loss of TDN because of the deteriorating nature of pasture if not fed when produced. Other feeds were transferred without loss.

Livestock enterprises generally require special inputs such as a dairy barn, poultry buildings, and feeding facilities. Dairy (observed on nine farms), market hog (observed on one farm) and broiler (observed on one farm) enterprises were restricted to those farms where these enterprises were observed. The feeder pig enterprise was restricted to the two farms producing feeder pigs in all but one solution of the analysis. In this solution all previous assumptions and conditions were held constant and all farmers having the required resources were allowed to produce feeder pigs. This was an attempt to measure the potential increase in income resulting from the incorporation of a feeder pig enterprise on low-income, minimum resource farms in East Tennessee.

Of the nine farms having a dairy enterprise, two were observed to have facilities too limited to accommodate the average size dairy on the farms surveyed. These small dairies were limited to 10 dairy cows each.

Although approximately 20% of the farms surveyed had a swine enterprise, most of them were small and limited to pork produced for home consumption. The farms observed having a commercial swine enterprise were also characterized as extremely small and having few hog or feeder pig production facilities. The commercial market hog operation on the farms was restricted to 15 hogs and the feeder pig operation on the two farms having the enterprise was limited to 10 sow-units each. The incorporation of these restrictions into the model tended to make

optimal farm plans more realistic in terms of existing facilities as well as reflecting the preferences of the livestock enterprise levels among the farm operators.

CHAPTER IV

RESULTS OF ANALYSES

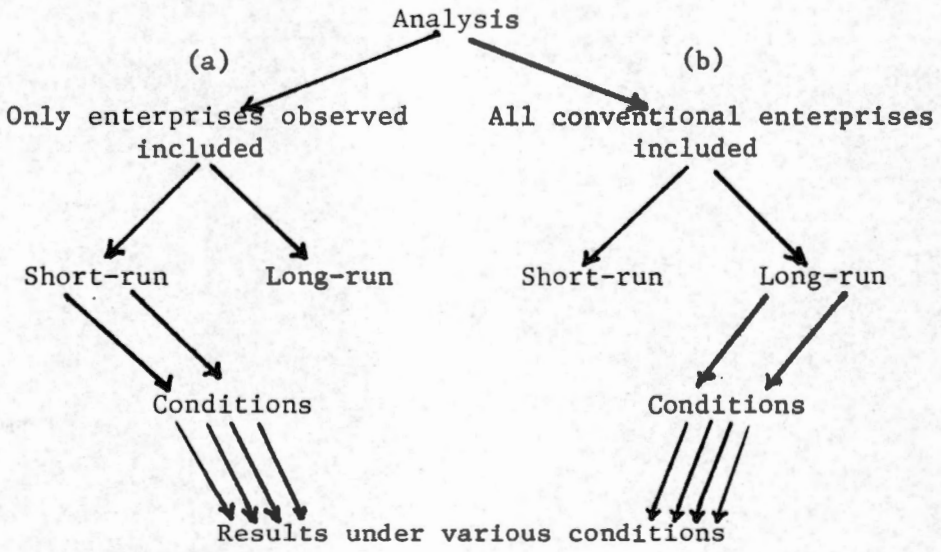
The meaning of "potential income" up to this point has been intentionally left ambiguous. The maximization of potential net income is conceptualized as that income which would result from the most efficient utilization of all available resources. Measuring net income from the optimization process requires certain assumptions -- assumptions which, according to their nature and degree, result in solutions reflecting static analyses to dynamic analyses.

Assumptions underlying a static or positive analysis may define a farm operator as having values which require, for instance, a certain number of beef cattle and a given amount of tobacco. Such an enterprise mix, again hypothetically, is traditional. The goals and values of a farmer -- what he feels should be -- may contribute to narrowing the range of enterprise possibilities. Such an optimization plan might restrict the number of enterprises possible to those actually engaged in with little or no deviation from year to year.

Looking at the other end of the spectrum, the dynamic or normative end, one may assume that the same farmer hypothesized above could built a dairy barn and buy dairy cows in order to have a highly profitable dairy enterprise. One might also assume that previously unused or "slack" labor may be employed in labor-intensive enterprises such as producing tomatoes, snap beans, or alternative vegetable crops. The enterprises could be combined resulting in a relatively high net income, a potential income which is unrealistic.

This study has attempted to cover the important areas within the broad spectrum of income potentials. Assumptions underlying a single optimization program have been relaxed and, conversely, further restricted in order to measure the effects of such changes on net income.

The format for the presentation of the analysis takes two forms: (a) allowing only those enterprises observed on a given farm to enter into the solution, and (b) allowing all conventional enterprises to enter into the solution. Each form of the analysis considers both the long- and short-term aspects. Diagramatically, the format would appear as follows:



Given the limitations of particular enterprises possible in making up an optimal mix, and given the quantity of resources available to produce the mix, profit maximization is dependent upon three variables: (a) yield per unit, (b) price per unit, and (c) cost of producing a unit of a particular enterprise.

The yield from a unit of a crop or livestock enterprise varies between and among farmers and can influence the overall profit of an operator. Yields used here are of two types: (a) average yields for the 12 county study area in 1976, and (b) yields obtained from improved management practices. Yields of both types are listed for the appropriate enterprises in Table 6.

Expenses required to produce a unit of production are also critical in determining how much of an enterprise to include in the income maximization solution. Crop enterprises have been budgeted for returns on "land owned," indicating the production by an operator on land which he owns; "land rented-in," indicating production on land the producer operates on a 50-50 share basis; and "land rented-out," indicating production from such land operated on a 50-50 share basis. Only those crops observed on the farms in the sample which rented land either in or out were budgeted and included at one time or another in the study.

Subsequent analyses reflect either a short-run or long-run optimal solution. Short-run decision making concerns itself with variable costs only. It is assumed that, in the short-run, the fixed assets -- machinery, buildings, etc. -- are available and that an optimal solution will utilize only variable costs. Stated in another way, the production of an additional unit of corn, for instance, requires only those incremental expenses directly incurred from producing that unit of corn -- seed, fertilizer, gasoline, repairs for equipment, etc. Long-run decision making, on the other hand, considers both the variable and fixed costs associated with the enterprise in assessing the income potential for a

TABLE 6. Yields of Livestock and Crop Enterprises: Average Yields and Improved Yields for Upper East Tennessee

Enterprise	Average Yield in 1976 for Study Area	Improved Yields
Crop (per acre):		
Burley tobacco	2,033 lbs.	2,400 lbs.
Burley tobacco: rent-in/out	2,033 lbs.	2,400 lbs.
Silage: bottom land	14 tons	14 tons
Silage: rotation land	12 tons	12 tons
Silage: rent-in	14 tons	14 tons
Pasture silage	7.5 tons	7.5 tons
Corn: rotation land	74 bu.	80 bu.
Corn: bottom land	64 bu.	70 bu.
Corn: rent-in/out	70 bu.	70 bu.
Hay	1.8 tons	2 tons
Hay: rent-in/out	1.8 tons	2 tons
Pasture: rotation land	2,489 tons	2,489 tons
Pasture: permanent	1,645 tons	1,645 tons
Oats	45 bu.	55 bu.
Oats: rent-in/out	45 bu.	55 bu.
Wheat	29 bu.	40 bu.
Wheat: rent-in/out	29 bu.	40 bu.
Vegetables:		
Tomatoes	25,000 lbs.	25,000 lbs.
Snap beans	133 bu.	133 bu.
Potatoes	95 cwt.	175 cwt.
Cantaloupes	125 cwt.	125 cwt.
Watermelons	250 cwt.	250 cwt.
Livestock (per animal unit):		
Dairy (milk)	7,700 lbs.	8,000 lbs.
Cow-calf: steer @510 lbs.	.44 hd.	.44 hd.
heifer @465 lbs.	.30 hd.	.30 hd.
Feeder pigs (sow unit) @45 lbs./hd.	15.50 hd.	15.50 hd.
Hogs (@230 lbs.)	1 hd.	1 hd.
Chicks	1 bird	1 bird

Source for average yield coefficients: U.S. Department of Commerce, Bureau of the Census. *U.S. Census of Agriculture, 1974.* Area Reports, Tennessee, U.S. Government Printing Office, 1976.

Sources for improved yields coefficients: S. O. Allen and W. Browning. "Farm Planning Manual for Kentucky Farmers." Agricultural Economics Extension Informational Series 11, Kentucky Agricultural Experiment Station, University of Kentucky, Lexington, Kentucky, 1973;

TABLE 6 (continued)

Thomas H. King. "An Economic Analysis of the Production, Packaging, and Marketing Potentials of Fresh Vegetables in Claiborne County, Tennessee." Unpublished Master's Thesis, University of Tennessee, Knoxville, Tennessee, December 1977. Pp. 97, 112; Robert M. Ray and Herbert N. Walch. "Farm Planning Manual." Agricultural Extension Service, University of Tennessee, Knoxville, Tennessee, (Revised) 1978). Pp. 18, 26, 38, 40, 50, 56, 98, 100, 114, 119; Daniel B. Smith, G. Ansel King, and Dan O. Ezell. "Selected Vegetable Budgets, South Carolina, 1976." Bulletin AE 390, Department of Agricultural Economics and Rural Sociology, Clemson University, Clemson, South Carolina, June 1976. Pp. 7, 13, 31; Fred J. Stewart. "Potential for Increased Net Incomes on Small Farms in Four Eastern Kentucky Counties." Unpublished Dissertation, University of Kentucky, Lexington, Kentucky, 1975. Pp. 146, 155; R. L. Williams. "Planning Guide for Small Farm Operators." Cooperative Extension Service, Mississippi State University, Mississippi State, Mississippi, 1973. Pp. 9, 17.

farm. It has been assumed that the cost of expanding a farming operation by introducing more profitable enterprises which have not been previously undertaken is reflected by the inclusion of the fixed costs into the objective function.

Product price, the final determinant of enterprise profitability, has also been divided into two categories: (a) 1976 average prices for Tennessee, and (b) the long-run average price based primarily on data from the *Farm Planning Manual* for Tennessee (Ray and Walch, 1978). These prices are shown in Table 7. Prices for 1976 have been employed primarily in the analyses which assume that an individual farmer is limited to the enterprises observed on his farm. Justification for this procedure is based on the fact that these type analyses are essentially short-run in character and that the results reflected the production decisions of the operator more accurately. Using 1976 prices was an attempt to minimize error when comparing bench mark net income to net income resulting from the optimization solution. Allowing free entry of enterprises not previously undertaken by a farm operator was considered to be a long-term adjustment in maximizing income utilizing long-run average prices.

I. BENCH MARK DATA

The analyses presented in this study are comparative. The potential net income is income resulting from the optimal employment of available resources under a set of conditions and enterprise alternatives. The results are then compared to the actual net income generated from the quantity of enterprises reported having been produced in 1976.

TABLE 7. Prices of Crop and Livestock Products for Tennessee, 1976 and Projected Trend

Product	Unit	Price	
		1976	Projected
Crop:			
Burley tobacco	lb.	$ 1.13	$ 1.20
Silage	ton	--	--
Corn	bushel	2.60	2.50
Oats	bushel	1.80	1.65
Wheat	bushel	3.05	2.75
Hay	ton	41.00	50.00
Pasture	--	--	--
Vegetables:			
Tomatoes	lb.	0.13	0.14
Snap beans	bushel	4.00	6.00
Potatoes	cwt.	5.95	4.15
Cantaloupes	cwt.	7.00	7.00
Watermelons	cwt.	2.50	2.50
Livestock:			
Milk	cwt.	8.00	8.50
Cow	lb.	0.24	0.24
Heifer	lb.	0.29	0.35
Steer	lb.	0.33	0.40
Sow	lb.	0.29	0.29
Feeder pigs	lb.	0.73	0.55
Hogs	lb.	0.63	0.35
Chicks	1000 birds	98.00	98.00

Sources: Tennessee Crop Reporting Service. *Tennessee Agricultural Statistics*. Bulletin T-14, Statistical Reporting Service, U.S. Department of Agriculture, September 1977; S. O. Allen and W. Browning. "Farm Planning Manual for Kentucky Farmers." Agricultural Economics Extension Informational Series 11, Kentucky Agricultural Experiment Station, University of Kentucky, Lexington, Kentucky, 1973. P. 21; Thomas H. King. "An Economic Analysis of the Production, Packaging, and Marketing Potentials of Fresh Vegetables in Claiborne County, Tennessee." Unpublished Master's Thesis, University of Tennessee, Knoxville, Tennessee, December 1977. Pp. 97, 112; Robert M. Ray and Herbert N. Walch. "Farm Planning Manual." Agricultural Extension Service, University of Tennessee, Knoxville, Tennessee, (Revised) 1968). Pp. 18, 26, 38, 40, 50, 56, 98, 100, 114, 119; Daniel B. Smith, G. Ansel King, and Dan O. Ezell. "Selected Vegetable Budgets, South Carolina, 1976." Bulletin AE 390, Department of Agricultural Economics and Rural Sociology, Clemson University, Clemson, South Carolina, June 1976. Pp. 7, 13, 31.

The actual net income base with which the results were compared has been referred to as the "bench mark" net income.

The measurement of "actual net income" has proved to be somewhat less straightforward than might first appear. Four income measurements representing the average net income for farms included in each of the limited resource groups were considered as a basis for comparing the net income derived from optimization procedures. These income measurements considered are as follows:

1. Reported net income - net income reported in the survey by by the farm operators.
2. Calculated net income - reported gross income from enterprise sales in 1976 less budgeted expenses per unit of enterprise produced.
3. Linear programming net income using average yields on observed enterprise levels - average enterprise yield times the 1976 product price less the budgeted production expenses for the enterprise.
4. Linear programming net income using improves yields on observed enterprise levels - above average enterprise yield times the 1976 product price less the budgeted production expenses for the enterprise.

The first three income measures were considered deficient in that these measurements did not represent a standard income for all farmers. Problems of accounting for product sales in a year other than that in which the product was produced were prevalent. Allowances for nonstandard items such as depreciation by the farm operators also

distorted the net income comparisons. Linear programming net income using improved yields on observed enterprise levels was the measure considered to be the best and most standard income for comparative purposes. The income obtained from this solution is the net income used throughout the study as a beginning point -- a bench mark income. Net income measurement alternatives are presented for each limited resource group of farms in Table 8.

Income, Enterprises and Resources

Bench mark income. The bench mark incomes of limited resource farm groups varied widely. The most limited resource group of farms, Group 1, had an average bench mark income of only $1,319 while group 4, comprising the dairy farms, had an average income of $15,533.

The variation between the two linear programming results -- those representing results using 1976 Upper East Tennessee average production coefficients and thos representing relatively higher yields used in the bench mark -- may be attributed to the incorporation of recommended management practices into the farming operations. These management practices, it was assumed, aided the farms in obtaining higher yields and increasing income. Farms with the most limited resources (Group 1) had the greatest potential for increasing income due to using good management practices. Net income of these farms increased by 6.5%. The dairy farms (Group 4), on the other hand, were able to increase their incomes by less than 2.0%. Improvement in income from incorporating good management practices appears to be minimal. A comparison of an alternative income measure using "L.P. income from improved yields" may be realistically more indicative of increased income

TABLE 8. Comparison of Net Income Measures Considered for Bench Mark Data, by Limited Resource Farm Group, in Upper East Tennessee, 1976

Income Measure	Limited Resource Farmer Group			
	1	2	3	4
	---------- Dollars ----------			
Reported income, 1974[a]	1,414	1,784	2,950	2,370
Reported income, 1976[b]	1,365	1,740	7,667	6,263
Calculated net income	1,239	2,599	6,331	9,970
L.P. income from average yields (short-run)	1,239	3,585	5,402	15,251
L.P. income from improved yields (short-run)	1,319	3,741	5,708	15,533

[a]Source: Survey of 287 Farmers in Upper East Tennessee, 1975.

[b]Source: Survey of 40 Farmers in Upper East Tennessee, 1977.

potential from using good management practices. Comparing this L.P. income measure with "calculated net income" indicates that improved management played a more important role in improving income for most farms.

Bench mark enterprise levels. The enterprise levels observed for each farm group are those for which the bench mark situation is applicable. Activities represented for the bench mark situation were restricted to those enterprises observed on each farm and only levels of those enterprises reported were allowed to enter the solution. Bench mark enterprise levels are shown in Appendix Table H-1.

The contribution of tobacco to total income was of major importance to all the farm groups except for the dairy farms comprising Group 4. As indicated in Table 9, farms making up Groups 1, 2, and 3 derived 67, 71, and 88%, respectively, of their total income from tobacco production. Relatively less importance was attached to tobacco for the dairy farms (Group 4). Although these farmers produced more tobacco than any other group of farmers on land which they owned (5,183 pounds), only 33% of the net income for dairy farmers was derived from tobacco production.

Row crops (corn, wheat, oats, and silage) and hay were of minor importance as contributors to income. Products from these enterprises were used largely as intermediate products -- products which were used as inputs for other farm enterprises (livestock and dairy). Pasture, the single greatest user of land by accounting for about 60% of the land use for the survey farms, was also an intermediate product.

TABLE 9. Contribution to Income by Enterprise for Bench Mark Enterprise Levels, by Limited Resource Farm Group, in Upper East Tennessee, 1976

Enterprise	Limited Resource Farm Group			
	1	2	3	4
Income (short-run)	$1,319	$3,741	$5,708	$15,251
	Percent			
Crop:				
Tobacco	67	71	88	33.4
Corn	0.5	1	4	0.1
Wheat	--	--	1.8	0.4
Oats	--	0.8	--	
Hay	--	0.5	1	--
Vegetables	0.2	5.5	4.2	--
Total Contribution From Crop Enterprises	68	79	99	34
Livestock:				
Dairy	--	5	--	60.2
Cow-Calf	31	14.2	1.2	0.3
Hogs and Feeder Pigs	1	2	--	--
Broiler	--	--	--	6.0
Total Contribution From Livestock Enterprises	32	21	1	66

Vegetable enterprises, which are labor-intensive enterprises, were of some importance to the limited resource farmers in Groups 2 and 3 only. Even though vegetable enterprises were profitable, only 5.5% of net income was derived from this source for the farmers in Group 2.

Dairying was of major importance to farmers in Group 4. These operators had an average of 26 dairy cows per farm. The importance of the dairy enterprise contribution to net income (60%) explains the status of tobacco as a secondary enterprise (33%). Group 2 farmers were the only other group of farmers which had a dairy enterprise, however income from dairy products was of minor importance to these farmers.

The net contribution to income from a cow-calf enterprise seemed to be negatively correlated with farm profit. The net contribution reflected the transformation of intermediate products into other final products. Group 1 farms which had an average of 11 beef cows per farm obtained 31% of their net income from beef. The cow-calf enterprise contributed only 1.0% to net income for farmers in group 3 and was negligible for farms with dairy enterprises.

Bench mark resources. The utilization of resources for generating bench mark incomes can be used to point out income potentials. Slightly less than 50% of available tobacco space capacity was utilized on the most limited resource group of farms which indicates forgone opportunities in tobacco production (Table 10). Operators of farms included in Group 1, as shown in Table 9, instead chose to least-out

TABLE 10. Resources Utilized for Observed Enterprise (Bench Mark) Levels, by Limited Resource Farm Group, in Upper East Tennessee, 1976

Resource[a]	Limited Resource Farm Group 1	2	3	4
Space Capacity:				
Tobacco (pounds)	1,269	3,012	4,710	6,798
	47%	73%	69%	77%
Hay (bales)	792	1,857	2,000	1,800
	74%	63%	88%	66%
Silage (tons)	--	7.8	--	194
		17%		49%
Labor:				
Peak period (hours)	120	363	630	935
	28%	53%	63%	96%
Annual total (hours)	350	1,016	1,693	4,065
	18%	35%	43%	98%
Land:				
Cropland (total tillable) owned (acres)	17.8	55	39.4	94
	96%	100%	99%	100%
Permanent pasture owned (acres)	8.5	15.5	15.5	14.9
	100%	100%	100%	99%
Cropland rented-in (acres)	2.0	6.8	24.5	17.9
	100%	100%	94%	100%
Permanent pasture rented-in (acres)	0	--	7.6	8
	0%		100%	100%

[a]Numbers are absolute quantities of resource. Percentages indicate the proportion of maximum available resource utilized.

(sell) an average of 317 pounds of tobacco per farm while leasing-in (buy) only 222 pounds. All other farm groups leased-in at least 1,000 pounds of tobacco poundage per farm which enabled them to utilize 70 to 80% of the available tobacco barn capacity (Table 10).

Labor is especially significant when analyzing farm profits. Only 28% of the peak-period labor and 18% of the annual labor that was available were used by farmers in Group 1. This is a significant underutilization of labor by the most limited resource farmers. The employment of available labor, by group, increased as income increased. Farmers in Group 4, for instance, used nearly 100% of the labor resources available in order to obtain their income level which was nearly 10 times the income level of the limited resource farmers in Group 1.

Labor resources were assumed to be homogeneous in this study. This assumption has its limitations because it is commonly accepted that the productive capacity of an individual is dependent upon factors such as age, health, and motivation. Fifteen percent of the farm operators interviewed indicated that they would be willing to quit farming entirely if an equally remunerative job were available. Half of these respondents were Group 1 farmers. Whether this attitude is a cause or a result of their low-income status has implications for current income earning ability. Thirty percent of all farm operators indicated the presence of physical health problems which limited their off-farm employment opportunities and limited the kind and amount of work they could do on the farm. These physical handicaps, such as an artificial limb, muscular dystrophy, emphysema, cancer, and bad back were reported by farmers who were mostly in the lower-income and more limited resource groups.

Age appeared to be an important factor in labor productivity. Net income of the four farmer groups seemed to be negatively correlated with age. Table 11 summarizes the average age of farmers surveyed as well as the percentage of farmers reporting health problems and dissatisfaction with farming as a source of income.

II. INCOME POTENTIAL FROM OPTIMUM MIX OF AVAILABLE RESOURCES ALLOWING ONLY OBSERVED ENTERPRISES ON THE FARMS

The results which have analyzed the income derived from an optimum mix of resources used to produce enterprise products observed on each farm under various restrictions are presented in this section. It was assumed in this analysis that farm operators would be willing to consider only the production from existing enterprises.

Limiting enterprise alternatives to those existing on a farm during the survey year was viewed as a means for measuring the short-run income potential. It was also an attempt to incorporate into the model the preferences of farm operators for enterprises which were familiar to them. Consequently, 1976 commodity prices for Tennessee were used to determine the income results.

Measuring the income potential from an optimum mix of observed enterprises was accompanied by various conditions alternately applied to the resources of the 40 survey farms. The restrictions imposed were:

1. Tobacco quota leased-in (for production on land owned) limited to 1,575 pounds; hay and corn production restricted for on-farm use, that is, for use as intermediate products only (Programs 2 and 2A).

TABLE 11. Productivity Capacity of Labor, by Limited Resource Farm Group, in Upper East Tennessee, 1976: Three Indicators

Indicator	Limited Resource Farm Group			
	1	2	3	4
Age (average)	58.4	55.1	53.3	51.7
Health Problems (percent of group)	17	57	0	14
Dissatisfaction with Farming (percent)	25	0	45	0

2. Hay and corn production restrictions as intermediate products only (Program 3).
3. Hay and tobacco barn space allowed to substitute (Program 4).

Selected enterprise levels for the solutions of the programs reflecting these three sets of assumptions are shown in Table 12. This information will be referred to periodically throughout the following discussion of these L.P. solutions. More detailed information of the results are outlined in Appendix Tables H-1 through H-5.

Allowing Only Observed Enterprises on Farms to Enter Solution; Tobacco Quota Leased-In Restriction; Hay and Corn Production Restricted

The analysis reflecting the assumptions which operated within this framework of the production and resource restrictions was a more positive and static analysis than all subsequent analyses. The solutions within this analysis were believed to represent the most realistic assumptions for making a determination of the short-run income potential of the farmers surveyed.

An increase in the quantity of tobacco produced from year to year was assumed to have limited potential on any one farm. This condition was incorporated into the model by restricting the amount of tobacco quota that any one operator was allowed to lease-in. This prevented a farmer from leasing-in uncharacteristically large amounts of tobacco quota. The tobacco quota which could be leased-in was consequently limited to 1,575 pounds per farm, which was the average tobacco quota leased-in by the operators who bought additional poundage in 1976.

Table 12. Net Incomes and Selected Enterprise Levels for Program Situations Allowing Only Observed Enterprise to Enter Solutions, by Limited Resource Farm Group, for 40 Farm Operators in Upper East Tennessee, 1976.

	Bench Mark Situation		Tobacco Quota Leased-In 1575 Lbs.		No Tobacco Quota Lease-In Restriction	Allow Tobacco And Hay Space To Substitute
	Short-Run (Program 1)	Long-Run (Program 1A)	Short-Run (Program 2)	Long-Run (Program 2A)	Short-Run (Program 3)	Short-Run (Program 4)
Group 1						
Net Income ($)	1,319	488	2,400	1,754	2,491	3,768
Tobacco (lbs.)	1,590	1,590	2,057	2,048	2,379	3,034
Corn (acres)	2.3	2.3	2.3	1.0	0.8	12.3
Hay (acres)	7.9	7.9	6.1	--	4.2	3.3
Pasture (acres)	19.7	19.7	18.3	13.7	14.2	5.8
Tomatoes (acres)	--	--	--	--	--	--
Snap Beans (acres)	.03	.03	0.6	0.6	0.6	0.6
Dairy (animal units)	--	--	--	--	--	--
Cow-Calf (animal units)	11	11	8.8	7.5	6.8	1.8
Feeder Pigs (sow units)	0.1	0.1	0.8	0.8	0.8	0.8
Group 2						
Net Income ($)	3,741	1,381	5,059	3,259	5,383	8,600
Tobacco (lbs.)	3,152	3,152	3,048	3,048	3,484	6,032
Corn (acres)	7.2	7.2	2.6	2.3	2.6	28.7
Hay (acres)	21.6	21.6	14.6	--	14.6	25.3
Pasture (acres)	45.5	45.5	46.5	43.8	46.5	7.6
Tomatoes (acres)	.14	.14	.22	.22	.22	.22
Snap Beans (acres)	--	--	--	--	--	--
Dairy (animal units)	0.5	0.5	1.4	1.4	1.4	0.7
Cow-Calf (animal units)	21	21	22.8	22.1	22.8	2.4
Feeder Pigs (sow units)	0.3	0.3	--	--	--	--
Group 3						
Net Income ($)	5,708	3,506	7,840	6,274	9,090	12,904
Tobacco (lbs.)	7,558	7,558	7,469	7.469	9,427	11,492
Corn (acres)	7.8	7.8	1.6	0.1	0.7	36.8
Hay (acres)	20.8	20.8	8.3	--	6.4	19.6
Pasture (acres)	49.7	49.7	34.9	22.1	28.1	8.7
Tomatoes (acres)	0.1	0.1	--	--	--	--
Snap Beans (acres)	0.5	0.5	1.6	1.6	1.6	1.6
Cow-Calf (animal units)	20.6	20.6	18	9.3	14.4	3.2
Feeder Pigs (sow units)	--	--	--	--	--	--
Group 4						
Net Income ($)	15,533	10,707	17,403	13,900	17,666	19,218
Tobacco (lbs.)	6,826	6,826	6,572	6,524	7,755	9,842
Corn (acres)	7.5	7.5	15.7	15.9	12.2	32.1
Hay (acres)	19.4	19.4	6.8	--	1.5	25.7
Pasture (acres)	77.4	77.4	72.1	58.5	70	40.6
Tomatoes (acres)	--	--	--	--	--	--
Snap Beans (acres)	--	--	--	--	--	--
Dairy (animal units)	26.4	26.4	28.4	27.3	27.3	21.4
Cow-Calf (animal units)	0.7	0.7	2.4	--	2.4	--
Feeder Pigs (sow units)	--	--	--	--	--	--

Hay and corn production was also restricted to that which could be used in the further production of dairy and livestock enterprises on the farm. This appeared a valid limitation because only small amounts of these products were sold by the farm operators surveyed in 1976. The restriction also disallowed a farmer who had been planting only one acre of corn, for instance, from planting and selling the equivalent of 30 acres. The production preference of the operators was thus incorporated into the model by restricting hay and corn production as intermediate products.

Short run: allowing only observed enterprises on farms to enter solutions; tobacco quota leased-in; hay and corn production restrictions (Program 2). The optimal enterprise combination and maximum income potential under conditions set forth here are detailed in Appendix Table H-2 and summarized in Table 12.

The most important measure in this short-run analysis was net income. The optimal enterprise combination enabled all farm operator groups to increase their net incomes by varying degrees. The percentage increase in the potential net income over the bench mark net income is shown below.

Group	Bench Mark S.R. Net Income -- Prog. 1 - $ -	S.R. Net Income in Current Solutions Restricting Tobacco Quota Leased-In -- Prog. 2 - $ -	Change in Net Income - % -
1	1,319	2,400	+82
2	3,741	5,059	+35
3	5,708	7,840	+37
4	15,533	10,707	+12
Overall Weighted Change			+46

The most limited resource group of farmers, Group 1, was able to increase net incomes by 82%, while the dairy farmers, Group 4, increased net incomes by only 12%. Overall, the 40 farm operators were able to adjust net incomes upward by nearly 50% through optimal resource use.

Despite the limitation placed on leasing-in tobacco quota, Group 1 and 2 farmers increased tobacco production while Group 3 and 4 farmers experienced a slight decrease. When looking at the importance of the contribution of tobacco to net income it can be seen from data in Table 13 that only Group 2 and 3 farmers had a significant change in their sources of net income over the bench mark levels. The change was one of proportionately less dependence on tobacco as an income source. Group 2 farmers reduced their income from tobacco as a percentage of total farm income from the bench mark level of 71% to 51% in the current solution. Farmers included in Group 3 averaged a reduction from 88% to 65%. The contribution of tobacco income to total income for farmers in Group 1 and 4 remained at previous levels of 65% and 30%, respectively. The income contribution from cow-calf enterprises for Group 2 and 3 farmers gained importance over bench mark contribution levels. A closer look, however, revealed that the average numbers of beef cows per farm in these two groups changed very little.

The increase in livestock and dairy production for the limited resource groups was aided by a reallocation of fewer resources to the hay enterprise, a comparatively expensive source of TDN. Good management of pastures enabled farmers to obtain more TDN from pasture land when normally the alternative forages are demanded, thus making it possible to reduce hay requirements.

TABLE 13. Contribution to Income by Enterprise for Income Maximization Solution, by Limited Resource Farm Group, in Upper East Tennessee, 1976: Short-Run Allowing Only Observed Enterprises on Farms to Enter Solution; Tobacco Quota Leased-In Limited to 1,575 Pounds; Hay and Corn Production Restricted as Intermediate Products Only (Program 2)

Enterprise	Limited Resource Farm Group			
	1	2	3	4
	--- Percent ---			
Crop:				
Tobacco	65	51	65	30
Corn	--	--	--	--
Wheat	--	--	7.8	1.2
Oats	--	4.5	--	--
Hay	--	--	--	--
Vegetables	3	6.4	15.6	--
Total Contribution From Crop Enterprises	98	62	88	31
Livestock:				
Dairy	--	10	--	63.4
Cow-calf	21	28	11.7	0.8
Hogs and feeder pigs	11	--	--	--
Broiler	--	--	--	4.5
Total Contribution From Livestock Enterprises	32	38	12	69

Wheat and oats production, on the average, increased for the farms observed having these enterprises. Vegetable enterprises for Group 3 farmers also contributed about 10% more to net income than was observed. Other farms having vegetable enterprises were not able to increase incomes much as a result of unrestricted snap bean and tomato production.

Resource utilization represents additional variables that should be considered when analyzing potentials for increasing incomes among limited resource farmers. Table 14 demonstrates more labor being used in the current situation than in the bench mark situation for the most limited resource group of farms. This was so even though peak-period labor capacity that was used was below 50%. It might be concluded that land is the limiting factor. However, only 7% of the available cropland rented-in was employed. The limitation of enterprise possibilities appears to be a possible constraint to added income potential for the most limited resource farms.

All the other groups of the limited resource farmers utilized about the same capacity of building facilities, labor, and land resources in this optimization program as was observed in the bench mark situation. The only resource exception was permanent pasture land, which, at $30 cash rent per acre, was too expensive for a farmer to rent-in.

Long-run: allowing only observed enterprises on farms to enter the solutions; tobacco quota leased-in restricted, hay and corn restricted as intermediate products only (Program 2A). The conditions imposed on the production possibilities in this analysis were identical to those

TABLE 14. Resource Capacity Utilized for Optimal Enterprise Combination by Limited Resource Farm Group, in Upper East Tennessee, 1976: Long-Run Allowing Only Observed Enterprises to Enter; Tobacco Quota Leased-In Restricted; Hay and Corn Production Restricted as Intermediate Products Only (Program 2A)

Resource	Limited Resource Farm Group			
	1	2	3	4
	---------- Percent ----------			
Space Capacity:				
Tobacco	67	68	75	73
Hay	44	49	39	15
Silage	--	9	--	21
Labor:				
Peak period	40	57	64	91
Annual total	23	36	43	98
Land:				
Cropland owned	94	93	99	88
Permanent pasture owned	94	100	88	49
Cropland rented-in	7	85	90	67
Permanent pasture rented-in	--	--	0	0

above -- only enterprises observed on a particular farm were allowed to enter the optimization solution of that farm -- except that fixed costs were considered factors of production. This was done mainly for comparative purposes and for considering the effects of observed (bench mark) enterprises on long-term net income using 1976 prices.

The optimal enterprise combination for the four limited resource groups over the long-run are detailed in Appendix Table H-3 and summarized in Table 12 (p. 67). A comparison of net returns to land, labor, capital, and management over the long-run averaged 28% less income than that generated under the optimum resource combination in the short-run. However, an overall weighted long-run income increase of 145% over the bench mark situation resulted when an optimal enterprise existed.

Group	Bench Mark L.R. Net Income -- Prog. 1A - $ -	L.R. Net Income in Current Solutions Restricting Tobacco Quota Leased-In -- Prog. 2A - $ -	Change in Net Income - % -
1	488	1,754	+260
2	1,381	3,259	+136
3	3,506	6,274	+ 79
4	10,707	13,900	+ 30
Overall Weighted Change			+145

The potential for increasing net income, therefore, appears more favorable in the long-run situation than in the short-run when existing enterprise levels were allowed to vary. An overall weighted increase of 46% in income resulting from optimal resource combinations over bench mark net income was attainable in the short-run whereas 145% income improvement was possible in the long-run.

The most apparent adjustment that farmers were required to make for maximizing income over the long-run was to change from producing their own hay to purchasing the hay they needed in the market. This adjustment reflects the proportionately high fixed machinery and hay field establishment cost for a hay enterprise. While an expenditure of $49 per ton was required for hay produced, the cost of hay in the market averaged $41 per ton in 1976.

Land freed from hay production could be optimally put into pasture on rotation land. Permanent pasture, costing the same as rotation land pasture but yielding only 65% as much TDN, became less attractive to most limited resource farmers and was consequently idle in the optimal solution.

Cow-calf operations remained at about the short-run levels, except for the limited resource farmers in Group 3. The cow-calf enterprise was reduced by 50% for this group of farms to allow for small increases in corn, wheat, and vegetable production.

Allowing Only Observed Enterprises on Farms to Enter Solution; Hay and Corn Production Restricted as Intermediate Products: Short-Run (Program 3)

The conditions employed in this short-run analysis were identical to those above except that there was no restriction on tobacco quota leased-in. Removing this restriction increased profits in most cases only by a minimal amount (Table 12, p. 67). A comparison of net incomes under the conditions employed here with incomes resulting from the prior set of short-run conditions which limited tobacco quota leased-in revealed the following changes.

Group	S.R. Net Income Restricting Tobacco Quota Leased-In -- Prog. 2 - $ -	S.R. Net Income in Current Solution With No Tobacco Quota Lease-In Restrictions -- Prog. 3 - $ -	Change in Net Income - % -
1	2,400	2,491	+ 4
2	5,059	5,383	+ 6
3	7,840	9,090	+16
4	17,403	17,666	+ 2
Overall Weighted Change			+ 6

An overall increase in income of only 6% indicates that the average amount of tobacco quota observed rented-in in 1976, 1,575 pounds, was near optimal. Farmers in the limited resource Group 3 gained most from the removal of the imposed tobacco leasing restriction by employing previously unused tobacco barn space and labor resources. Approximately an additional acre of tobacco was produced under these conditions by Group 3 farmers. The labor resources required for growing the additional tobacco were diverted from the cow-calf enterprise.

Allowing Only Observed Enterprises on Farms to Enter Solution; Hay Sales, Corn Sales, and Hay-Tobacco Space Substitution Allowed: Short-Run (Program 4)

The conditions analyzed in this section take the income potential of limited resource farms from the static setting to approach one representing more dynamic conditions. In this setting corn and hay production were allowed to exceed that used only as intermediate products so that both hay and corn may be sold. It was assumed that hay and corn can be sold directly after harvest or stored and sold later. Additionally, hay and tobacco storage space were allowed to substitute

at a rate of one unit (bale) of hay space to 1.5 units (pounds) of tobacco space.

Income increases resulted under the new set of conditions over the prior set of assumptions disallowing hay and tobacco substitution and, proportionately, by a large margin.

Group	S.R. Net Income With No Tobacco Quota Lease-In Restriction -- Prog. 3 - $ -	S.R. Net Income in Current Solution Allowing Tobacco and Hay Space to Substitute -- Prog. 4 - $ -	Change in Net Income - % -
1	2,491	3,768	+51
2	5,383	8,600	+60
3	9,090	12,904	+42
4	17,666	19,218	+ 9
Overall Weighted Change			+45

Table 12 (p. 67) shows vividly the adjustments required for maximum profit under these dynamic conditions. Cow-calf enterprises all but disappeared for all farms in the limited resource groups while other livestock and dairy numbers remained constant. Pasture requirements were consequently greatly reduced. Vegetable production remained fairly stable. Wheat and oats production disappeared from the optimal solution for all farms.

Hay production nearly doubled and accounted for 36% of all cropland utilized by the farmers in the four limited resource groups. The additional hay was not for utilization as an intermediate product, but for sale as a final product.

Group	Solution With No Tobacco Quota Lease-In Restriction -- Prog. 3			Current Solution Allowing Tobacco and Hay Space to Substitute--Prog. 4		
	Cropland Utilized -acres-	Hayland -acres-	Hay/ Cropland -percent-	Cropland Utilized -acres-	Hayland -acres-	Hay/ Cropland -percent-
1	14.2	4.2	30	17.4	3.3	19
2	51.7	14.6	28	51.7	25.3	49
3	36.8	5.2	14	39.4	19.6	50
4	82.3	1.5	2	88.0	25.7	29
Overall Weighted Hayland/Cropland			20			36

All groups, except for the first low-income, minimum resource one, have had hay acreage increased to the point that hay was produced on 36% of all owned cropland, whereas only 21% of the cropland was observed to have been used in hay production for the bench mark situation. Keeping in mind that fixed costs are quite high for hay production and that the current short-run analysis considers only variable costs, hay produced and sold as a final product is probably not a viable adjustment alternative.

Corn production and subsequent corn sales increased considerably, reflecting the profitability of the enterprise. The average corn acreage per farm was six acres for the bench mark situation whereas a four-fold increase to 26 acres occurred for the current solution. Although only those farmers with existing corn production in 1976 were allowed to produce and sell unlimited quantities of corn under the conditions assumed, many of the same farmers in 1976 harvested their corn (usually only a few acres) by hand, or had it custom harvested. Under these circumstances, it is unlikely, without capital expenditures for additional corn production equipment, that farmers in the region will produce more corn.

III. INCOME POTENTIAL FROM OPTIMUM MIX OF AVAILABLE RESOURCES ALLOWING ALL CONVENTIONAL AND SELECTED SPECIALTY ENTERPRISES ON THE FARMS

The income potential of farms from restricting enterprise alternatives to those observed on individual farms has been examined. Now, the income potential on farms where crop alternatives have been expanded to include most crops grown in the area as alternative enterprises will be examined. In doing this, it was assumed that all the farmers surveyed had the managerial capacity and desire to engage in any enterprise that would maximize net incomes from their operations.

The adjustments necessary for farm operators to change enterprises -- add new ones, and drop existing, unprofitable ones -- would actually take place over a time period of several years. The long-term consequences of such adjustments were therefore considered and analyzed by incorporating both variable and fixed costs (long-run) into the objective function. Average product prices were used when measuring the effects of long-term adjustments and 1976 prices were used when measuring the effects of the short-run considerations.

Measurement of the income potential under the assumption of enterprise mobility was accompanied by conditions alternatively applied to an optimization program. All livestock (except cow-calf) and dairy enterprises, unless otherwise indicated, were again restricted to those farms where these enterprises were observed.

The limiting conditions for the programs analyzed were:

1. Allowing all conventional crop enterprises to enter with corn

and hay production restricted as intermediate products only (Program 5 and 5A),

2. Allowing all conventional crop enterprises to enter as well as tomatoes and snap beans with corn and hay production restricted as intermediate products only (Program 6 and 6A),
3. Allowing all conventional crop enterprises to enter as well as tomatoes and snap beans. Feeder pig production was also allowed on all farms (Program 7A).

A summary of the program results are included in Table 15. This information will be referred to periodically throughout the following discussion of the L.P. solutions. Details of the results are outlined in Appendix Tables H6 - H9.

Allowing All Conventional Crop Enterprises to Enter Solution; Corn and Hay Production Restricted as Intermediate Products

The set of conditions imposed upon the optimization programs represented here was the most restrictive when analyzing the income potential allowing free entry of conventional enterprises into a farm solution, whether or not they had been observed on a particular farm. "Conventional enterprises" in this context refers to crop enterprises actually practiced by at least 10% of all farmers in the region. As indicated in Chapter II (pp. 19-28), wheat, oats, soybeans, potatoes, and nursery products were enterprises produced by fewer than 10% of the Upper East Tennessee farm operators. Vegetable products, specialty-type crops, produced by fewer than 10% of the farmers were disallowed in this analysis as enterprise alternatives. Crop enterprises which

Table 15. Net Incomes and Selected Enterprise Levels for Program Situations Allowing Alternative Enterprises to Enter Solutions, by Limited Resource Farm Group, in Upper East Tennessee, 1976.

	Bench Mark Situation		No Vegetables or Feeder Pigs		Vegetables Allowed		Feeder Pigs Allowed
	Short-Run (Program 1)	Long-Run (Program 1A)	Short-Run (Program 5)	Long-Run (Program 5A)	Short-Run (Program 6)	Long-Run (Program 6A)	Long-Run (Program 7A)
Group 1							
Net Income ($)	1,319	488	2,554	2,176	4,186	4,600	7,208
Tobacco (lbs.)	1,590	1,590	2,635	2,635	2,635	2,635	2,463
Corn (acres)	2.3	2.3	0.8	1.7	1.0	1.3	10.1
Hay (acres)	7.9	7.9	4	0.2	3.2	--	--
Pasture (acres)	19.7	19.7	12.4	10.7	10.4	8.4	12.9
Tomatoes (acres)	--	--	--	--	0.7	0.7	0.3
Snap Beans (acres)	.03	.03	--	--	3.8	4.1	1.3
Dairy (animal units)	--	--	--	--	--	--	--
Cow-Calf (animal units)	11	11	6.3	6.0	5.2	5.0	--
Feeder Pigs (sow units)	0.1	0.1	0.8	0.8	0.8	--	41
Group 2							
Net Income ($)	3,741	1,381	5,465	4,400	7,528	7,781	13,347
Tobacco (lbs.)	3,152	3,152	3,995	3,995	3,954	3,949	3,949
Corn (acres)	7.2	7.2	4.8	8.4	4.8	6.9	48.3
Hay (acres)	21.6	21.6	15.6	1.3	14.1	--	--
Pasture (acres)	45.5	45.5	48.2	45.6	44.5	40.2	25.5
Tomatoes (acres)	0.1	0.1	--	--	0.9	1.0	0.1
Snap Beans (acres)	--	--	--	--	5.2	5.8	0.2
Dairy (animal units)	0.5	0.5	1.4	1.4	1.4	1.2	--
Cow-Calf (animal units)	21.0	21.0	21.4	26.1	22.8	24.0	--
Feeder Pigs (sow units)	0.3	0.3	0.7	0.7	0.71	0.71	76
Group 3							
Net Income ($)	5,708	3,506	7,750	6,955	10,805	12,058	17,877
Tobacco (lbs.)	7,558	7,558	9,170	9,596	9,506	9,617	8,165
Corn (acres)	7.8	7.8	1.4	2.9	1.3	2.2	40.1
Hay (acres)	20.8	20.8	10.0	--	8.2	--	--
Pasture (acres)	49.7	49.7	30.4	29.4	26.2	18.4	35.5
Tomatoes (acres)	0.1	0.1	--	--	1.2	1.4	0.2
Snap Beans (acres)	0.5	0.5	--	--	8.5	9.0	1.4
Dairy (animal units)	--	--	--	--	--	--	--
Cow-Calf (animal units)	20.6	20.6	12.1	17.7	13.7	11.4	--
Feeder Pigs (sow units)	--	--	--	--	--	--	112
Group 4							
Net Income ($)	15,533	10,707	19,292	18,321	19,366	18,555	22,846
Tobacco (lbs.)	6,826	6,826	8,857	8,857	8,859	8,640	8,857
Corn (acres)	7.5	7.5	47.8	48.4	47.3	40.1	80.6
Hay (acres)	19.4	19.4	--	--	--	--	--
Pasture (acres)	77.4	77.4	62	61.7	52.3	57.5	41.1
Tomatoes (acres)	--	--	--	--	0.1	0.1	--
Snap Beans (acres)	--	--	--	--	--	3.4	--
Dairy (animal units)	26.4	26.4	30.8	30.9	30.2	28.0	--
Cow-Calf (animal units)	0.7	0.7	--	--	--	--	--
Feeder Pigs (sow units)	--	--	--	--	--	--	133

were subsequently allowed in the analysis were tobacco, grain corn as an intermediate product, corn silage, hay for feed, and pasture. Land rented-in remained restricted to the amount of tobacco observed as rented even though all other enterprise alternatives were permissible in unlimited quantities on rented land.

Short-run: allowing all conventional crop enterprises; corn and hay production restricted as intermediate products (Program 5). Two comparative measures were used to evaluate the adjustments required to maximize income under short-run conditions. One comparative measure was that representing the bench mark situation, that is the enterprise levels and net incomes actually observed on survey farms. The other represented similarly restrictive conditions imposed on the second of the three optimization programs in the last section where only those crops observed on farms were allowed to enter (Program 3). Restrictions in Program 3 limited hay and corn production as intermediate products only and imposed no limitation on the amount of tobacco quota that might be leased-in.

Income levels under these conditions, as shown in Table 15, have increased by 55% over bench mark levels.

Group	S.R. Bench Mark Net Income -- Prog. 1 - $ -	S.R. Net Income in Current Solution Disallowing Vegetable and Feeder Pig Production -- Prog. 5 - $ -	Change in Net Income - % -
1	1,319	2,554	+94
2	3,746	5,465	+46
3	5,708	7,750	+36
4	15,533	19,292	+24
Overall Weighted Change			+55

A comparison with the similar optimization program which did not allow enterprise mobility demonstrated a more sporadic income adjustment pattern as shown below

Group	S.R. Net Income With No Tobacco Quota Lease-In Restriction -- Prog. 3 - $ -	S.R. Net Income in Current Solution Disallowing Vegetable and Feeder Pig Production -- Prog. 5 - lbs -	Change in Net Income - lbs -
1	2,491	2,554	+ 3
2	5,383	5,465	+ 2
3	9,090	7,750	-15
4	17,666	19,292	+ 9
Overall Weighted Change			+ 1

Limited resource farms in Group 3 experienced a 15% reduction in net income relative to the similar optimization program results. This decrease was attributed to vegetable, oat and wheat production having been disallowed in the current program. These nonconventional enterprises had been allowed to enter into the similar optimization program used in the comparative analysis for farms observed producing these products. There was little net income change overall.

The increase in tobacco production by most farmers was a major reason for income increases over the bench mark levels. Tobacco production increased overall by 38% over the bench mark levels.

Group	Tobacco Production for Bench Mark Situation -- Prog. 1 - $ -	Tobacco Production for Current Solution Disallowing Vegetable and Feeder Pigs Prog. 5 - $ -	Change in Tobacco Production - % -
1	1,590	2,635	+66
2	3,152	3,995	+27
3	7,558	9,170	+21
4	6,826	8,857	+30
Overall Weighted Change			+38

Tobacco production was also increased by 10% in the current solution over the level of the comparative optimization program.

Corn production remained relatively unchanged from the levels in the comparative program with similar restrictions. The major adjustments were with the dairy farms on which corn production was decreased on land owned. Subsequently, corn production from land rented-in and corn which had to be bought was used to meet dairy feed requirements. Much of this land freed from corn production went into pasture on rotation land. All other activities and enterprise levels remained at the same approximate levels as in the comparative program with similar restrictions.

Long-run: allowing all conventional crop enterprises; corn and hay production restricted as intermediate products (Program 5A). Long-run income levels (Table 15, p. 80), which accounted for fixed costs, were greatly improved over the levels observed in the bench mark situation.

Group	L.R. Net Income for Bench Mark Situation -- Prog. 1A - $ -	L.R. Net Income for Current Solution Disallowing Vegetables and Feeder Pigs -- Prog. 5A - $ -	Change in Net Income - % -
1	488	2,176	+346
2	1,381	4,400	+218
3	3,507	6,955	+ 98
4	10,707	18,321	+ 71
Overall Weighted Change			+209

The income potentials for the current solution relative to bench mark levels were favorably skewed to the most limited resource groups

of farmers. Farmers in Group 1, for example, were able to increase their incomes by 346% over the bench mark level by allowing the mobility of conventional enterprises. Dairy farmers in Group 4, on the other hand, registered an increase of only 71%.

Long-run income over the bench mark situation obtained when the levels of existing enterprises were varied in a prior analysis increased by 260% and 136% for farmers in Groups 1 and 3, respectively. By allowing enterprise mobility in the current analysis, income for farmers in these groups could be increased by 346% and 218% over bench mark levels. Thus, the hypothesis that farmers with the most limited resources are at a greater disadvantage in terms of potential income increases than other farmers -- not so much for their limited resource situation, but because of the relatively limited production of high profit enterprises observed existing on these farms -- is supported by this pattern. Shifting enterprises to higher-profit ones appears to be a key factor to increasing farm income on the limited resource farms surveyed.

Allowing All Conventional Crop Enterprises Including Tomato and Snap Bean Production; Hay and Corn Production Restricted as Intermediate Products

The set of conditions represented in this analysis was an attempt to assess the potential for increased vegetable production as a means for increasing farm income. Vegetable production in Upper East Tennessee during 1976 was limited to only 474 farms covering approximately 1,750 acres (*U.S. Census of Agriculture*, 1974). More than 90% of the area

cultivated in vegetables was produced by 65% of the farmers who were classified as commercial farmers.[5] Average sales from vegetable production in 1974 was $3,400 for these commercial farmers in the region while sales from all crops averaged only $4,300 per farmer in the 12 county area. Furthermore, the gross revenue from vegetables was obtained from only about five acres of land for each vegetable farmer. Vegetable production would, therefore, appear to be an attractive enterprise alternative for many small, limited resource farms. The intensive cropping characteristics of tobacco, which has increased tobacco production considerably over the past quarter century, appears to be equally suited to vegetables by enabling farmers with limited land and capital resources to use their excess labor for such labor-intensive enterprises.

Despite the apparent suitability of vegetable crops for labor-abundant, smallholder farmers, vegetable acreage has declined within the study area over the 10 year period from 5,458 acres in 1964 to 1,738 acres in 1974, a three-fold decline. This is perhaps indicative of, among other things, the sophisticated production and marketing techniques required for such crops. Although tobacco production has some similar characteristics to that of vegetables, the greater degree of management required may be a deterrent to vegetable production, thus its decline in popularity among limited resource farmers in Upper East Tennessee.

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[5]The census defines a commercial farmer as one having gross farm sales of at least $2,500 in 1974.

A critical assumption underlying the potential for vegetable production was that there exists a viable market for tomatoes and snap beans, the two most predominant and familiar vegetable crops grown by farmers in East Tennessee. Present marketing outlets for vegetables may, in actuality, be lacking in some counties of the study area. However, a general increase in the supply of tomatoes and snap beans would tend to create additional demand for packing houses and other outlets.

This analysis has retained all the assumptions of the previous analyses as they relate to other enterprises -- hay, corn, wheat, oats, and livestock -- in order to isolate and measure the effects of vegetable production as an adjustment alternative for increasing income.

Short-run: allowing all conventional crop enterprises and specialty vegetable crops; hay and corn production restricted as intermediate products (Program 6). Vegetable production allowed most farm operators to balance land and labor resources by utilizing more labor while land utilization remained fairly constant. An overall summary of the enterprise changes resulting is characterized as tomato and snap bean cultivation having become supplemental rather than substitute enterprises with those traditional enterprises already existing.

Tobacco production remained at essentially maximum production levels given the limited barn capacity available for tobacco curing (Table 15, p. 80). This indicates a preference of tobacco over similar labor-intensive vegetable enterprises. Even though these enterprises compete largely for labor, tobacco production resulted in an hourly

return to land, labor, capital, and management of approximately $6.63. Tomato and snap bean enterprises had a comparative hourly return of only $2.44 and $1.47, respectively.[6]

All other conventional enterprises -- corn, silage, pasture, and hay -- remained at the same levels as in the previous optimization program where vegetable production was disallowed.

Vegetable production increased significantly on the survey farms to just over five acres per farmer when allowed to enter the program. Vegetables contributed to an overall 40% increase in income over the identical situation when vegetable production was disallowed.

Group	S.R. Net Income Disallowing Vegetables -- Prog. 5 - $ -	S.R. Net Income in Current Solution Allowing Vegetables -- Prog. 6 - $ -	Change in Net Income - % -
1	2,554	4,186	+64
2	5,465	7,528	+38
3	7,750	10,805	+39
4	19,292	19,366	+ 0.4
Overall Weighted Change			+40

The disparity in average incomes of farms in the limited resource groups at both extremes was also narrowed. While dairy farmers earned seven to eight times more net income than farmers in the most limited resource group when vegetable production was disallowed, the difference declined to between four and five when vegetable production

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[6]The same pattern between tobacco and vegetables held true when fixed costs and average prices were taken into account for a long-run analysis. Tobacco, tomato, and snap bean production had hourly returns of $6.34, $2.46, and $3.74, respectively.

was allowed. This is an indication that vegetable production has a positive effect on the earning ability of the most limited resource farmers.

This increased income has not come about by maintaining a constant use of resources. For example, the labor capacity utilized was greatly increased for farm operators, in general, but comparatively more for the most limited resource farmers, in particular. A comparison between the resources and capacities utilized without vegetable production and with vegetable production is presented in Table 16.

The production of vegetables allowed farmers to productively use part of their abundant labor resource which was primarily responsible for increased incomes. Labor use by the most limited resource group of farmers is an exmaple of this. Approximately 40% of the peak-period labor and 25% of the annual labor resources available to these farmers were used in the optimization program which did not include vegetable production. The introduction of vegetable enterprises, however, increased peak-period labor utilization to 100% for the most limited resource group of farmers. Dairy farmers, on the other hand, used no additional labor when vegetables were introduced, but their income increased by only half a percent while income for the most limited resource farmers more than doubled.

The diversification of enterprise alternatives was also accompanied by a reduced dependence of farm operators on tobacco as a source of income. Only among Group 3 farmers, a group with relative abundant tobacco barn space, did tobacco income account for more than 50% of total net income (Table 17).

TABLE 16. Resource Capacity Utilized for Optimal Enterprise Solution, by Limited Resource Farm Group, in Upper East Tennessee, 1976: Short-Run With and Without Vegetable Production

Resource (By Group)	Resources and Capacities Utilized[a]			
	Without Vegetable Production (Program 5)		With Vegetable Production (Program 6)	
	Man-Hours	Percent	Man-Hours	Percent
Peak-Period Labor				
Group				
1	170	39	444	100
2	333	49	626	91
3	550	55	1018	100
4	897	92	895	95
Annual Labor				
Group				
1	450	24	1238	65
2	1092	37	2127	73
3	1292	33	3169	81
4	4078	99	4094	99
Cropland Owned (acres)				
Group				
1	14.6	79	15.9	86
2	55.0	100	55.2	100
3	34.7	72	38.0	95
4	94.0	100	93.0	99

[a]Numbers represent absolute quantities of a particular resource, percentages represent available resource capacity utilized.

TABLE 17. Contribution to Income by Enterprise for Income Maximization Solution, by Limited Resource Farm Group, in Upper East Tennessee, 1976: Short-Run Allowing All Conventional Crop Enterprises and Selected Specialty Vegetable Crops; Hay and Corn Production Restricted as Intermediate Products Only (Program 6)

Enterprise	Limited Resource Farm Group			
	1	2	3	4
	Percent			
Crop:				
Tobacco	48	42	61	28
Tomato	28	20	18	1
Snap bean	11	9	10	--
Total Contribution From Crop Enterprises	87	71	89	29
Livestock:				
Feeder pigs and hogs	6	1	--	--
Cow-calf	7	26	11	--
Dairy	--	2	--	69
Broiler	--	--	--	2
Total Contribution From Livestock Enterprises	13	29	11	71

Although diversification led to an even greater dependency on crop enterprises over bench mark levels for farmers in Groups 1 and 2, the makeup of the crop enterprises became more varied. Livestock levels, except for Group 1 farmers where cow-calf numbers declined, remained comparatively unchanged indicating vegetables supplemented rather than substituted for livestock enterprises.

Long-run: allowing all conventional crop enterprises and specialty vegetable crops; hay and corn production restricted as intermediate products (Program 6A). Average product prices over a designated time period and with fixed costs included in the objective function as determinants for optimal enterprise combinations is a more accurate way of determining limited resource farm income potentials. Implied within these determinants is the longer-term adjustment period required by farmers to make enterprise changes to produce vegetable crops.

Higher average prices under this long-run alternative have offset the fixed production costs and thus net incomes over the short-run alternative increased for the three most limited resource farmer groups. Dairy farms, with proportionately higher fixed costs, was the only group whose net incomes were not increased. The income gap between Group 1 farmers and Group 4 farmers lessened. Under this arrangement the most limited group of farmers realized a net income of $4,600 per farm while dairy farmers earned four times more, or $18,555.

Group	L.R. Net Income Disallowing Vegetables -- Prog. 5A - $ -	L.R. Net Income in Current Solution Allowing Vegetables -- Prog. 6A - $ -	Change in Net Income - % -
1	2,176	4,600	+111
2	4,400	7,781	+ 77
3	6,955	12,058	+ 73
4	18,321	18,555	+ 1
Overall Weighted Change			+ 73

The general pattern of both crop and livestock production levels was similar here to that of the short-run incorporating the same production restrictions. There was an even greater dependency on labor-intensive crops which required relatively fewer fixed inputs (Table 18). The crop enterprises, all labor-intensive, accounted for 98% and 97% of available labor capacity for farms in Groups 1 and 3, respectively. Only dairy farmers among the limited resource farmers, those included in Group 4, retained their previous enterprise mix where the dairy enterprise was the major source of income.

Several additional adjustments took place. Hay requirements, because of the proportionally higher fixed production costs, were purchased and were no longer produced by any of the limited resource farmers. Land freed from hay production was generally utilized as pasture. Permanent pasture requirements were consequently reduced and this permanent pasture was idled. Given the assumptions in this study, permanent pasture land has no alternative enterprise possibilities.

Vegetable production tended to shift more to snap bean production due largely to a higher average price in the long-run than in the short-run where 1976 product prices were employed. Dairy farmers, who had not

TABLE 18. Contribution to Income by Enterprise for Income Maximization Solution, by Limited Resource Farm Group, in Upper East Tennessee, 1976: Long-Run Allowing All Conventional Crop Enterprises and Selected Specialty Vegetable Crops; Hay and Corn Production Restricted as Intermediate Products Only (Program 6A)

Enterprise	Limited Resource Farm Group			
	1	2	3	4
	Percent			
Crops:				
Tobacco	42	40	54	28
Tomato	27	21	18	1
Snap beans	29	24	25	6
Total Contribution From Crop Enterprises	98	85	97	35
Livestock:				
Feeder pigs and hogs	1	1	--	--
Cow-calf	1	13	3	--
Dairy	--	1	--	65
Total Contribution From Livestock Enterprises	2	15	3	65

previously produced snap beans, now found it profitable to use an average of three acres for this enterprise. The average number of dairy animals subsequently dropped from 30 to 28 cows per farm.

In concluding this analysis, it can be stated that vegetable production has a potential of being an important enterprise to consider for improving farm income. Thus far, only the analysis which allowed the substitution of hay space with tobacco space was equally as encouraging.

Allowing All Crop Enterprises, Hay and Corn Sales, Tomato and Snap Bean Specialty Crops, and Feeder Pig Production

In this section the effects of feeder pig production on the income potential for limited resource farmers are analyzed. Thus far, only the farmers observed that produced feeder pigs were allowed to continue limited pig production throughout the optimization plans evaluated. Pork production on farms observed in 1976 produced feeder pigs primarily for home consumption rather than for sale. This is reflected in the statistics that half a percent of all livestock sales on survey farms were attributed to swine.

Sales from pork production in the 12 county study area, according to the *U.S. Census of Agriculture,* 1974, accounted for only 2.5% of all livestock sales. Even though swine production has not traditionally been a predominant enterprise on East Tennessee farms, its importance as an enterprise has declined even more in recent years. The number of pigs farrowed in 1974 declined to less than 50% of the 1959 level. Only 4% of East Tennessee farmers sold pigs in 1974, and these sold the equivalent of six sow-litters.

Feeder pig production, like vegetable and tobacco production, is a fairly labor-intensive activity. An advantage of producing feeder pigs over producing vegetables and tobacco is that the labor requirements for pig production is spread more evenly throughout the year, thereby allowing the farm operator to utilize more man hours of labor during the year. Vegetable and tobacco enterprises, characteristically having relatively high returns per hour of labor, may restrain profits by using the available labor resource in a particular production phase, such as the harvesting or grading operation. Consequently, potential profit-earning labor lies idle during nonpeak months which could be used in pig production if such labor were allowed to enter the optimal program.

Several elements exist which tend to diminish the potential of the commercial feeder pig enterprise. A major drawback is that pig production, like vegetable production, demands a high degree of newly acquired management skills. Furthermore, proposed feeder pig production which might be suited to small farm situations requires facilities, such as a farrowing house, which generally are not available. Even if the management skill were present and the facilities available, market outlets for feeder pigs may not be adequate. The limited swine production of all types in the region suggests that marketing outlets within close proximity to the producers are inadequate for accomodating significant increases in feeder pig production. The lack of markets, facilities, and management skills may be considerable deterrents to feeder pig production.

Long-run: allowing all crop enterprises, vegetable production,

and feeder pig production (Program 7A). The most differentiating characteristic that dominated this long-run consideration was the income that resulted from feeder pig sales. Income increases averaged 40% over the already high income that resulted from vegetable production. Put another way, the potential income from feeder pig production would be eight times greater than the long-run income actually observed for the bench mark situation. It was also observed that the resource advantages of the limited resource farm groups declined in relative importance as income-generating labor available was pushed to capacity for all groups. The net revenue created from the new enterprise combinations decreased the average income of dairy farmers to only three times that of the most limited resource group.

Labor used for tobacco production was reduced for all limited resource groups so that constant monthly labor requirements for pig production could be made available. Vegetable production also declined considerably and now made only a minimal contribution to total net income. This reduction of tomato and snap bean production was proportionately less for the most limited resource farms than for the other farms included in this study.

The only remaining final product sales of any significance -- and the most important -- were those resulting from feeder pig production. The dominance of this enterprise is reflected by the fact that most of the net farm income derived shifted from cropping enterprises to the feeder pig enterprise which ranged from 41 sow units for Group 1 limited resource farmers to 133 sow units for the limited resource dairy farmers. Cow-calf and dairy enterprises left the optimal solution in favor of the more profitable feeder pig enterprise.

CHAPTER V

IMPLICATIONS, CONCLUSION, AND SUMMARY

I. IMPLICATION OF THE RESULTS ON RESOURCE VALUES

Compatability of Labor Resources and Enterprise Alternatives

Optimal use of resources available to limited resource farm operators in Upper East Tennessee resulted in improved net incomes relative to observed bench mark income levels. Profit maximization was identified as the sole objective of each farmer. In some cases, adjustments in the levels of existing farm enterprises generated the increase in incomes. In others, the addition of new enterprises contributed the most to increased net income potential.

This demonstration of the potential for increasing net income was brought about, not in a vacuum characterized only by enterprise combination adjustments, by the increased employment of productive labor and other resources within a farming operation. Table 19 summarizes the net income potential per labor hour employed for selected analyses as a result of varying conditions and restrictions which were imposed upon farm production possibilities. The gradual relaxation of the restrictions resulted in both increases in income and the number of available labor hours expended in order to produce this income. Farmers in Group 1, for instance, were observed to have worked an average of 350 hours in 1976 in order to produce $1,319 net income. When feeder pigs were allowed to enter the solution, 1,919 hours, a 400% increase, were required to realize an increased profit of $7,208.

TABLE 19. Returns to Labor for Six Selected Resource Combination Programs Analyzed, by Group, for 40 Farm Operators in Upper East Tennessee, 1976

Group Variables	Observed	Restrict Enterprises to Those Observed			Enterprise Mobility		
		Leased-In Tobacco < 1,575[a]	No Lease Restriction[a]	Substitution of Hay and Tobacco	Conventional Enterprises[a]	Vegetables[a]	Feeder Pigs
Group 1							
Income (dollars)	1,319	2,400	2,491	3,768	2,554	4,186	7,208
Annual labor (hours)	350	446	453	510	450	1,238	1,910
Hourly return (dollars)	3.77	5.38	5.50	7.39	5.67	3.38	3.77
Group 2							
Income (dollars)	3,741	5,059	5,383	8,600	5,465	7,528	13,347
Annual labor (hours)	1,016	1,054	1,110	1,309	1,092	2,127	2,915
Hourly return (dollars)	3.68	4.80	4.85	6.57	5.00	3.54	4.24
Group 3							
Income (dollars)	5,708	7,840	9,090	12,904	7,750	10,805	17,877
Annual labor (hours)	1,693	1,665	1,871	2,250	1,292	3,169	3,903
Hourly return (dollars)	3.37	4.71	4.86	5.74	6.00	3.41	4.60
Group 4							
Income (dollars)	15,533	17,403	17,666	19,218	19,292	19,366	22,846
Annual labor (hours)	4,065	4,073	4,055	3,937	4,078	4,094	4,136
Hourly return (dollars)	3.82	4.27	4.36	4.88	4.73	4.73	5.52

[a]Hay and corn are allowed to be produced as intermediate products only.

The net income per hour of labor employed varied as conditions and restrictions varied. The most limited resource group of farmers, Group 1, had an average hourly return of $3.77 for the bench mark situation. The return declined to $3.38 per hour when vegetable production was allowed to enter. This same general pattern for income per labor hour used existed for all groups, except the dairy farmers, as shown in Figure 1. A general trend of increasing hourly income persisted over the first four programs specified which allowed for existing or conventional enterprises to enter the program. The introduction of vegetable production had the effect of increasing the hours of labor employed at a rate greater than total net income increased. The result was a decline in income per hour of labor used.

The trade-off existing between income adjustments and labor resources employed is an indication which suggests that increased net income may not be the only goal of a farm operator. It follows that a doubling of labor inputs by area farmers -- which vegetable and feeder pig production required in the optimization program -- may not be consistent with the actual goals of an operator.

Opportunity Cost of Land, Labor, and Tobacco Resources

Thus far, only the resources observed available as inputs for production have been considered when assessing the income potential of limited resource farmers. The unavailability of hired labor, additional land, and tobacco barns reported by the farmers surveyed restricted their inclusion into the programming considerations as available resources. The admission of unlimited quantities of the

Figure 1. Net Returns Per Hour of Labor Used for Selected Resource Groups, 40 Farm Operators in Upper East Tennessee, 1976.

Resource Combination Situation	Description of Situation
1	Observed enterprise levels used for bench mark data.
2	Restrict enterprises to those observed. Tobacco quota leased in $\leq$ 1,575 pounds. Hay and corn restricted for use as intermediate products only
3	Restrict enterprises to those observed. Hay and corn restricted for use as intermediate products only
4	Restrict enterprises to those observed. Allow tobacco and hay space to substitute.
5	Enterprise mobility. Allow only conventional enterprises to freely enter. Hay and corn restricted for use as intermediate products only.
6	Enterprise mobility. Allow conventional enterprises and vegetable enterprises. Hay and corn restricted for use as intermediate products only.
7	Enterprise mobility. Allow conventional enterprises as well as vegetable and hog enterprises.

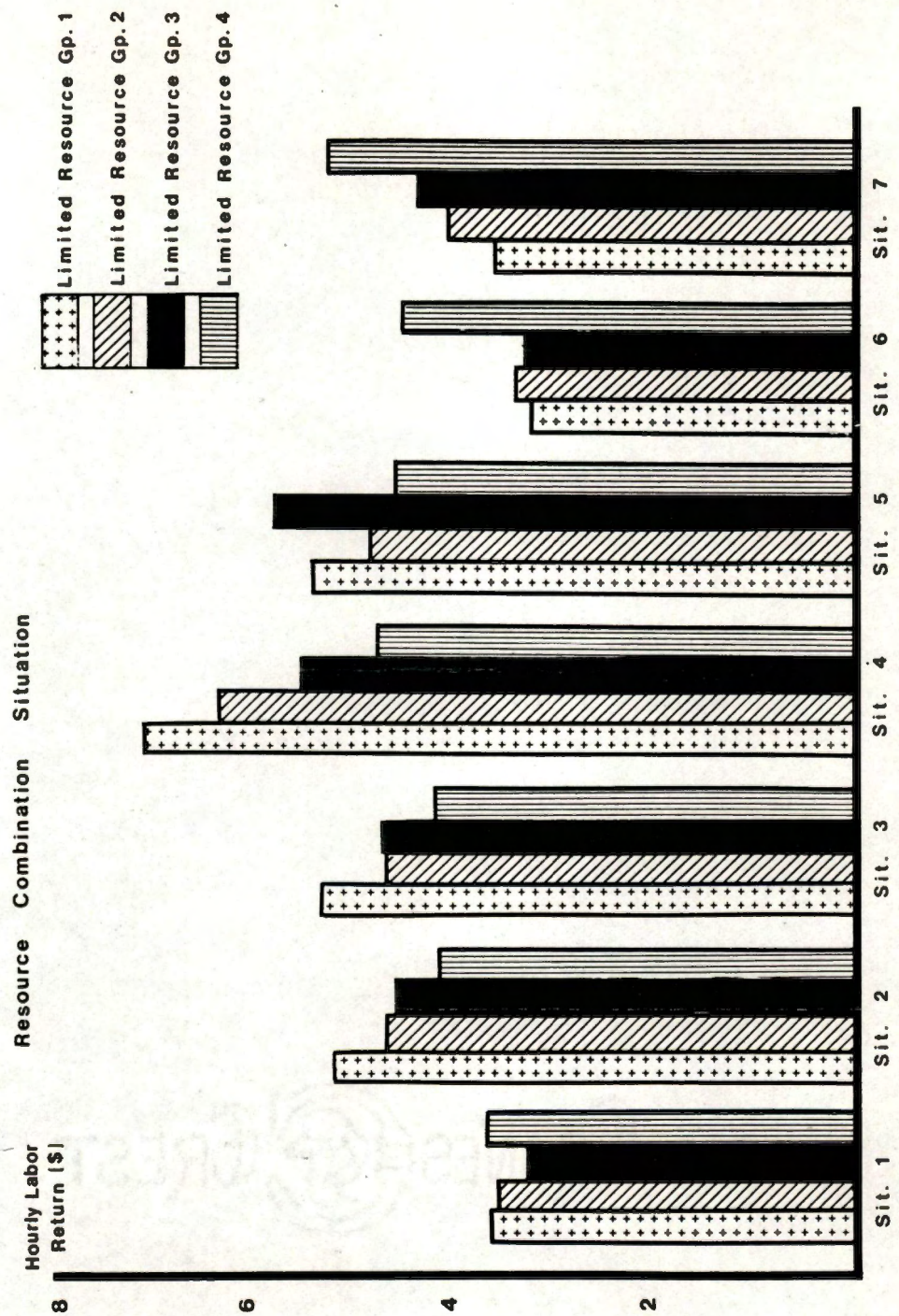
Hourly Labor Return ($)
8
6
4
2
Resource Combination Situation
Sit. 1
Sit. 2
Sit. 3
Sit. 4
Sit. 5
Sit. 6
Sit. 7
Limited Resource Gp. 1
Limited Resource Gp. 2
Limited Resource Gp. 3
Limited Resource Gp. 4

FIGURE 1

critical inputs would have resulted in either an "unbounded" solution representing no constraining resources or an unrealistically inflated net income potential.

Assuming, however, that these additional constraining resources were available to farm operators in limited quantities, how might the nature of agriculture be adjusted over time in order to reflect the economic forces with economic efficiency as a corner stone to this process? Three inputs have been analyzed using the "shadow price" or marginal value of an additional unit of a particular resource as an indicator of opportunity cost.

Changing conditions and assumptions reflected in the linear programs within this study were accompanied by changing marginal values associated with as additional unit of a particular resource. Two points of reference were taken in order to evaluate the marginal productivity of a resource. The short-run marginal productivity is represented by the conditions in the program analyzed which allowed only those enterprises observed on a farm to enter, restricted hay and corn production as intermediate products, and placed no restriction on tobacco quota leased-in (Program 3). The long-run marginal productivity is represented by the analysis allowing enterprise mobility with the production of all conventional crop and cow-calf enterprises while other livestock enterprises remained limited to those levels observed (Program 5A). These two programs were viewed as realistic assessments of the income potential given the conventional nature of agriculture in the area. The opportunity cost of selected resources for the two programs are shown in Table 20.

TABLE 20. Marginal Productivity of Selected Resources, by Limited Resource Farm Group, of Selected Short-Run and Long-Run Programs for 40 Farm Operators in Upper East Tennessee, 1976[a]

Program and Resources	Limited Resource Farm Group							
	1		2		3		4	
	-$-	-%-	-$-	-%-	-$-	-%-	-$-	-%-
Short-Run:								
Labor (annual), per hour	0.00	0	4.50	15	0.00	0	5.80	100
Cropland (own), per acre	27.00	66		70	22.00	100	44.00	71
Permanent pasture (own)	18.00	42	17.00	57	12.00	71	10.00	29
Tobacco space, per pound	0.60	67	0.71	79	0.62	86	0.25	57
Long-Run:								
Labor (annual), per hour	7.10	8	3.30	7	7.10	30	3.60	100
Cropland (own), per acre	12.70	50	14.00	93	11.00	71	38.00	100
Permanent pasture (own)	0.00	0	12.00	7	0.00	0	15.00	30
Tobacco space, per pound	0.64	92	0.66	100	0.57	100	0.23	100
Hay space, per bale	0.44	42	0.33	36	0.34	29	0.00	0

[a]Dollar values are the average of those farms having a positive opportunity cost value for a particular resource; accompanying percentages represent the portions of a group having a positive opportunity cost.

The opportunity cost for additional labor had positive values for all dairy farmers in both the short-run and long-run. These farmers would be willing to pay up to $5.80 in the short-run and $3.60 in the long-run for an additional hour of labor. Few farms included in the other groups, on the other hand, would find it profitable to employ additional labor in their farming operations. Of these, farms in Group 3 appear to have the greatest long-run prospects for increased income through additional labor resources.

Cropland and permanent pasture opportunity costs, unlike labor, had a positive value to the majority of farms. Dairy farms were willing to pay up to $44 rent for an acre of cropland in the short-run while other groups would rent land only if it were available at between $22 to $27 per acre. The opportunity cost of pasture land was approximately half that of cropland and it was attractive to fewer farmers than was cropland as a means for increasing income.

Accounting for variable and fixed costs in the long-run, both cropland and permanent pasture become less attractive. Renting cropland was profitable only if its price were decreased by a substantial amount over the short-run opportunity cost. Farms in Group 1 would be willing to pay only $12.70 rent for an acre of cropland in the long-run; farms in Group 2, $14; farms in Group 3, $11; and farms in Group 4, $38. The Tennessee Valley Authority (TVA) reported that row-cropland rents for $25 per acre and the Federal Land Bank receives an average rent of $30 for cropland. The utilization of rented farmland in Upper East Tennessee, therefore, appears not to be a viable adjustment alternative in the longer-run for the limited resource farmers included in the study.

Additional tobacco barn capacity appears to offer an attractive alternative to adjustment. Whereas it costs about $.10 annually to store a pound of tobacco[7], farmers would be willing to pay considerably more in both the short-run and long-run. Groups 1, 2, and 3 -- the most limited resource groups -- would pay up to an average of $.65 per pound for additional barn capacity. Dairy farmers, because of the existing attractiveness of their enterprise mix, would pay $.25.

Allowing other labor-intensive enterprises to enter would result in labor becoming a constraining resource for more farms. Under these conditions, hiring labor would tend to become more attractive for increasing net income. However, the limitations of these nonconventional enterprises essentially discounts such adjustments. The more logical approach of increasing the net incomes of limited resource farmers in Upper East Tennessee is by operating within the framework of conventional enterprises. This would point to the acquisition of more resources for increasing tobacco production.

II. CONCLUSION

Many adjustments in East Tennessee agriculture have taken place over the past decade in order for farm operators to increase their incomes. Other adjustments -- an extension of those already occurring and the incorporation of new cnes -- are required if the farms in the area are to remain in the mainstream of American agriculture.

The major conclusion of this study is that farm operators on low income, limited resource farms in East Tennessee have the potential for increasing their incomes. These income increases can

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[7]Assuming a $6,760 initial investment for a tobacco barn (prorated over 30 years and requiring annual repairs valued at $15).

be brought about by a reallocation of farm resources to generate an optimal enterprise combination. Those farms having the smallest resource bases were found to be capable of increasing their incomes by a proportionately greater amount than other farms. The resource advantages of the different levels of resource base farms tended to decline in relative importance as income generating labor available was pushed to capacity for all groups.

Survey farms, in general, were able to maximize their incomes by incorporating feeder pig enterprises into the farm operations. Assumptions represented by this program reflected the most dynamic conditions and least restrictive analysis undertaken in this study. Net income under these conditions rose from an average long-run bench mark level of $4,346 to $13,960 for all farms. Disallowing feeder pig production and allowing the substitution of hay and tobacco capacity was the next best adjustment for the middle limited resource farm groups (Groups 2 and 3). Short-run net income per farm increased from a bench mark level of $5,422 to $9,762 under these conditions. The incorporation of vegetable production was marginally the next best alternative for farms in limited resource Groups 1 and 4 where short-run net income rose to an average of $9,176 for all farm operators.

The least dynamic program restricted enterprises allowed to those observed on a farm, allowed for no vegetable or feeder pig production on farms where these enterprises were not observed, allowed for no substitution of hay capacity for tobacco capacity, and limited the amount of tobacco quota leased-in to 1,575 pounds per farm. This program allowed the farms to increase their incomes by an average of 27% in the short-run to an average of $6,908 per farm.

Most major crop and livestock enterprises -- dairy, beef, and pasture -- remained at their observed bench mark levels in the optimization programs. Tobacco, vegetable and feeder pig production increased when allowed and hay production decreased.

Due to the sophisticated production and marketing techinques and nonconventional nature associated with vegetable and feeder pig enterprises, an adjustment to increase tobacco production appeared to offer the best alternative in which to maximize income on low-income, limited resource farms.

III. SUMMARY

Alternative adjustments for increasing net income which are available to farm operators in Upper East Tennessee are: upgrading technology employed on the farm, consolidating land resources, obtaining off-farm employment, migrating to urban areas, and shifting crops and livestock enterprises to more profitable ones. The primary objective of this study was to explore the possibilities for improving the income position of full-time, limited resource farm operators by means of enterprise shifts as an adjustment alternative.

Forty full-time farmers with gross earnings of less than $10,000 in 1976 were interviewed and data concerning resource availability, enterprise organization, and current income position were obtained. These farms were categorized, based upon the operator's resource levels and income-earning criteria, into four resource groups.

Technical coefficients were generated from various sources for

crop and livestock enterprises. Linear programming was used to maximize the net income of each farm under various conditions and assumptions.

The analyses represented in this study were divided into two categories: (1) those limiting enterprise alternatives to those that existed on a farm, and (2) those allowing varying degrees of enterprise mobility. Each analysis incorporated either variable expenses into the objective function which represented a short-run solution, or variable and fixed expenses which represented a long-run solution.

A bench mark net income for each farm was obtained by permitting only the reported crop acreages and livestock numbers as enterprise possibilities. This solution was used as a point of reference for the optimization programs in this study.

Each successive linear program in the study relaxed previously imposed restrictions to simulate adjustments going from static conditions to dynamic ones. Potential net income in all programs for all groups exceeded the bench mark level. The farms classified as having the smallest resource base and least income-earning ability, tended to increase their incomes by a proportionately greater amount than those farms having the most abundant resources. This was due largely to increasing labor resources employed on the more limited resource farms.

In one of the more restrictive programs -- limiting enterprise alternatives to those that existed on a farm, allowing tobacco quota leased-in to not exceed 1,575 pounds, and limiting hay and corn production as intermediate products -- the most limited resource group of

farms increased their net incomes from a bench mark level of $1,319 to $2,400, an 82% increase, while the least limited resource group of dairy farms increased their incomes from $15,533 to $17,403, a 12% increase.

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APPENDICES

APPENDIX A

SOIL CLASSIFICATION

Class I: Soils of this class are easy to farm and have no more than slight limitations in use. They may be used for intensive cultivation without any special measures to control excess water or erosion. They may be expected to produce high yields under normal good management. There are no subclasses to this class.

Class II: Soils of this class can be used for tilled crops and have only moderate conservation problems or limitations. There are three subclasses: erosion hazard, wetness, and soil limitations in the root zone.

Class III: Soils that have one or more serious conservation problems when used for tilled crops. There are three subclasses similar to those in Class II.

Class IV: Soils that have very serious conservation problems when cultivated requiring very careful treatment and management. Soils are generally suited for pasture, orchards and woodland. There are three subclasses to this class.

Class V: Nonexistent in Tennessee.

Class VI: Soils requiring permanent vegetation, usually long producing pasture and forage, and having only moderate conservation problems under such use. There are two subclasses: erosion hazard and soil limitation at the root zone.

Class VII: Soils generally suited to trees. The more favorable sites are suited to limited grazing. There are two subclasses like those in Class VI.

APPENDIX B

Table B-1. Linear Programming Tableau (Recommended Management Practices) Part 1.

	Burley Tobacco	Grain Corn				Corn Silage				Pasture Silage	Wheat	Oats	Hay (feed/sell)		Hay (sell)	
		Bottomland		Rotation Land		Bottomland		Rotation Land								
		Own Eq	Custom	Own Eq	Custom	Own Eq	Custom	Own Eq	Custom				Own Eq	Custom	Own Eq	Custom
Net Return ($)																
Objective 1	2409	-65	-79	-65	-79	-108	-133	-108	-133	-68	65	49	-40	-52	60	48
Objective 2	2145	-84	-89	-84	-89	-152	-151	-152	-151	-97	49	33	-99	-91	2	9
Objective 3	2241	-65	-79	-65	-79	-108	-133	-108	-133	-68	44	39	-40	-52	46	30
Objective 4	1977	-84	-89	-84	-89	-152	-151	-152	-151	-97	28	23	-99	-91	-16	-9
Labor (hrs.)																
Jan.-Feb.	10.0	—	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mar.-Apr.	7.8	3.0	3.0	3.0	3.0	1.13	1.13	1.13	1.13	--	--	--	--	--	--	--
May-June	46.4	2.0	2.0	2.0	2.0	1.12	1.12	1.12	1.12	3.4	1.0	1.0	2.6	1.6	2.6	1.6
July-Aug.	23.0	1.0	1.0	1.0	1.0	.37	.37	.37	.37	—	.2	.2	3.1	2.1	3.1	2.1
Sept.-Oct.	90.8	2.0	0.5	2.0	2.0	2.50	.26	2.50	.26	1.1	--	--	--	--	--	--
Nov.-Dec.	159.8	1.0	0.5	1.0	1.0	--	--	--	--	.5	1.35	1.35	--	--	--	--
Annual	337.8	9.0	7.0	9.0	7.0	5.12	2.88	5.12	2.88	5.0	2.55	2.55	5.7	3.7	5.7	3.7
Land Owned (acres)																
Bottom		1	1			1	1									
Rotation				1	1			1	1							
Cropland	1	1	1	1	1	1	1	1	1				1	1	1	1
Permanent pasture																
Storage Space																
Tobacco (lbs.)	2400															
Hay (tons)													100	100		
Silage (tons)						14	14	12	12	10						
Accounting Rows																
Silage (TDN)						-5880	-5880	-5040	-5040	-3600						
Corn (TDN)		-3600	-3600	-3150	-3150											
Hay (TDN)													-1720	-1720		
Tobacco-Own (lbs.)																
Tobacco-Lease (lbs.)																
Transfer Pasture (TDN)																
Nov.-Feb.																
March																
Apr.-May																
June-Aug.																
Sept.-Oct.																
Transfer TDN																
Nov.-Feb.																
March																
Apr.-May																
June-Aug.																
Sept.-Oct.																

Table B-2. Linear Programming Tableau (Recommended Management Practices) Part 2.

	Oat Hay	Rotation Pasture	Permanent Pasture	Vegetable Enterprises: Tomatoes	Snap Beans	Watermelon	Cantaloupe	Potatoes	Animal Enterprises: Dairy	Cow-Calf	Feeder Pigs	Market Hogs	Broilers
Net Return ($)													
Objective 1	-63	-18	-18	1817	384	494	528	200	626	150	247	34	69
Objective 2	-87	-30	-30	1588	337	484	498	180	582	139	216	33	42
Objective 3	-63	-18	-18	1579	132	494	528	39	562	126	368	52	69
Objective 4	-87	-30	-30	1350	85	484	498	23	518	115	337	50	42
Labor (hrs.)													
Jan.-Feb.	--	--	--	--	0.5	0.6	2.0	2.0	18	2.7	4.4	.2	4
Mar.-Apr.	--	--	--	23.8	19.5	4.6	5.9	2.5	17	1.4	3.8	.2	3
May-June	3.5	.5	.5	97.2	70.0	--	61.8	30.5	15	0.7	3.8	.2	4
July-Aug.	--	.8	.8	524.0	--	81.0	--	40.0	15	0.7	4.3	.2	3
Sept.-Oct.	2.1	--	--	--	--	--	--	10.0	17	1.4	3.8	.2	4
Nov.-Dec.	--	--	--	.8	--	--	--	--	18	1.9	3.9	.2	4
Annual	5.6	1.3	1.3	645.8	90.0	86.2	69.9	85.0	100	8.8	24.0	1.2	22
Land Owned (acres)													
Bottom													
Rotation													
Cropland	1	1		1	1	1	1	1					
Permanent pasture			1										
Storage Space													
Tobacco (lbs.)													
Hay (tons)													
Silage (tons)													
Accounting Rows													
Silage (TDN)													
Corn (TDN)									2025		2007	937	
Hay (TDN)	-1700									1064			
Tobacco-Own (lbs.)													
Tobacco-Lease (lbs.)													
Transfer Pasture (TDN)													
Nov.-Feb.		-204	-140							245	56	45	
March		-263	-181							317	72	60	
Apr.-May		-1076	-740							913	296	350	
June-Aug.		-467	-321							562	128	150	
Sept.-Oct.		-382	-263							460	105	130	
Transfer TDN													
Nov.-Feb.									2080	194			
March									520	--			
Apr.-May									1040	--			
June-Aug.									1560	749			
Sept.-Oct.									1040	359			

Table B-3. Linear Programming Tableau (Recommended Management Practices) Part 3.

	Corn		Hay		Transfer Grain Corn					Transfer Silage					Transfer Hay				
	Buy	Sell	Buy	Sell	N-F	M	A-M	J-A	S-O	N-F	M	A-M	J-A	S-O	N-F	M	A-M	J-A	S-O
Net Return ($)																			
Objective 1	-2.5	2.5	-50	50															
Objective 2	-2.5	2.5	-50	50															
Objective 3	-2.6	2.6	-41	41															
Objective 4	-2.6	2.6	-41	41															
Labor (hrs.)																			
Jan.-Feb.																			
Mar.-Apr.																			
May-June																			
July-Aug.																			
Sept.-Oct.																			
Nov.-Dec.																			
Annual																			
Land Owned (acres)																			
Bottom																			
Rotation																			
Cropland																			
Permanent Pasture																			
Storage Space																			
Tobacco (lbs.)																			
Hay (tons)																			
Silage (tons)																			
Accounting Rows																			
Silage (TDN)										420	420	420	420	420					
Corn (TDN)					45	45	45	45	45										
Hay (TDN)	-45	45													860	860	860	860	860
Tobacco-Own (lbs.)			-860	860															
Tobacco-Lease (lbs.)																			
Transfer Pasture (TDN)																			
Nov.-Feb.																			
March																			
Apr.-May																			
June-Aug.																			
Sept.-Oct.																			
Transfer TDN																			
Nov.-Feb.					-45					-420					-860				
March						-45					-420					-860			
Apr.-May							-45					-420					-860		
June-Aug.								-45					-420					-860	
Sept.-Oct.									-45					-420					-860

Table B-4. Linear Programming Tableau (Recommended Management Practices) Part 4.

	Transfer Rotation Pasture					Transfer Permanent Pasture					Transfer Delayed Grazing Pasture					Rent-Out	
	N-F	M	A-M	J-A	S-O	N-F	M	A-M	J-A	S-O	N-F	M	A-M	J-A	S-O	Burley Tobacco	Grain Corn
Net Return ($)																	
Objective 1																1215	-26
Objective 2																1003	-26
Objective 3																1131	-26
Objective 4																9.9	-26
Labor (hrs.)																	
Jan.-Feb.																	
Mar.-Apr.																	
May-June																	
July-Aug.																	
Sept.-Oct.																	
Nov.-Dec.																	
Annual																	
Land Owned (acres)																	
Bottom																	
Rotation																	1
Cropland																	
Permanent Pasture																1	1
Storage Space																	
Tobacco (lbs.)																2400	
Hay (tons)																	
Silage (tons)																	
Accounting Rows																	
Silage (TDN)																	
Corn (TDN)																	-1575
Hay (TDN)																	
Tobacco-Own (lbs.)																2400	
Tobacco-Lease (lbs.)																	
Transfer Pasture (TDN)																	
Nov.-Feb.	204					140						140					
March		263					181						181				
Apr.-May			1076					740						740			
June-Aug.				467					321						321		
Sept.-Oct.					382					263	263						
Transfer TDN																	
Nov.-Feb.	-204					-140					-244						
March		-263					-181					-121					
Apr.-May			-1076					-740					-172				
June-Aug.				-467					-321					-492			
Sept.-Oct.					-382					-263					-170		

Table B-5. Linear Programming Tableau (Recommended Management Practices) Part 5.

	Transfer Space		Lease-In Tobacco							Lease-Out Tobacco						
	Hay to Tobacco	Tobacco to Hay														
Net Return ($)																
Objective 1			-.10	-.13	-.15	-.19	-.20	-.25	-.27	.10	.13	.15	.19	.20	.25	.27
Objective 2			-.10	-.13	-.15	-.19	-.20	-.25	-.27	.10	.13	.15	.19	.20	.25	.27
Objective 3			-.10	-.13	-.15	-.19	-.20	-.25	-.27	.10	.13	.15	.19	.20	.25	.27
Objective 4			-.10	-.13	-.15	-.19	-.20	-.25	-.27	.10	.13	.15	.19	.20	.25	.27
Labor (hrs.)																
Jan.-Feb.																
Mar.-Apr.																
May-June																
July-Aug.																
Sept.-Oct.																
Nov.-Dec.																
Annual																
Land Owned (acres)																
Bottom																
Rotation																
Cropland																
Permanent pasture																
Storace Space																
Tobacco (lbs.)	-1.5	1.5														
Hay (tons)	1.0	-1.0														
Silage (tons)																
Accounting Rows																
Silage (TDN)																
Corn (TDN)																
Hay (TDN)																
Tobacco-Own (lbs.)			-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1
Tobacco-Lease (lbs.)			1	1	1	1	1	1	1							
Transfer Pasture (TDN)																
Nov.-Feb.																
March																
Apr.-May																
June-Aug.																
Sept.-Oct.																
Transfer TDN																
Nov.-Feb.																
March																
Apr.-May																
June-Aug.																
Sept.-Oct.																

Table B-6. Linear Programming Tableau (Recommended Management Practices Part 6)

	Rent-In											
	Burley	Corn					Hay		Rotation	Permanent		Snap
	Tobacco	Silage	Own Eq	Custom	Wheat	Oats	Own Eq	Custom	Pasture	Pasture	Tomato	Bean
Net Return ($)												
Objective 1	1193	-69	-37	-51	29	34	-70	-82	-48	-48	1757	324
Objective 2	1140	-113	-56	-61	13	8	-128	-121	-60	-60	1528	277
Objective 3	1056	-69	-37	-51	18	29	-70	-82	-48	-48	1519	72
Objective 4	2400	-113	-56	-61	2	2	-128	-121	-60	-60	1290	25
Labor (hrs.)												
Jan.-Feb.	1.0	--	--	--	--	--	--	--	--	--	--	.5
Mar.-Apr.	7.8	1.1	3	3	--	--	--	--	--	--	23.8	19.5
May-June	46.4	1.1	2	2	1.0	1.0	2.6	1.6	.5	.5	97.2	70.0
July-Aug.	23.0	.4	1	1	.2	.2	3.1	2.1	.8	.8	524.0	--
Sept.-Oct.	90.8	2.5	2	.5	--	--	--	--	--	--	--	--
Nov.-Dec.	159.8	--	1	.5	1.4	1.4	--	--	--	--	.8	--
Annual	337.8	5.1	9	7	2.6	2.6	5.7	3.7	1.3	1.3	645.8	90.0
Land Rented(acres)												
Bottom												
Rotation												
Cropland	1	1	1	1	1	1	1	1	1		1	1
Permanent Pasture										1		
Storage Space												
Toacco (lbs.)												
Hay (tons)							100	100				
Silage (tons)		7										
Accounting Rows												
Silage (TDN)		-2940										
Corn (TDN)			-1575	-1575								
Hay (TDN)							-1720	-1720				
Tobacco-Own (lbs.)												
Tobacco-Lease (lbs.)												
Transfer Pasture (TSN)												
Nov.-Feb.									204	140		
March									263	181		
Apr.-May									1076	740		
June-Aug.									467	321		
Sept.-Oct.									382	263		
Transfer TDN												
Nov.-Feb.												
March												
Apr.-May												
June-Aug.												
Sept.-Oct.												

APPENDIX C

PROCEDURE, METHODOLOGY, AND VARIABLES USED FOR CLASSIFICATION OF FARMS INTO HOMOGENEOUS GROUPS

Variables used in determining the basis for grouping farms -- from those with the most limited resource base (Group 1) to those with the least limited resources (Group 4) -- were:

1. land-labor index
2. tobacco space index
3. dairy enterprise potential
4. observed net income
5. net income potential in the short-run

Ranking a farm within a particular decision variable -- land-labor, tobacco space, dairy potential, observed income, and potential income -- was represented by five or six delineations, depending on the variable and are shown in Table C-1. Each delineated portion of the ranking included a + or - area (weighted as +0.5 or -0.5), which further stratified the farms by indicating whether a given farm fell near the top or bottom quarter of a category. Using the tobacco space variable as an example, assume that a farmer had available 5,100 units (pounds) of space. He would be assigned a 3- index for this particular variable. Another farmer having 5,800 units would be assigned an index of 3

Each farm's resource availability or income making ability was evaluated and ranked within the divisions referred to above and a unique index derived for each farm by adding the individual variable

TABLE C-1. Delineated Areas Within Variables Used for Farm Grouping

Variables	Index	Delineated Areas
Land (units) X Labor (hours)	1	9,300-18,500
	2	23,000-60,000
	3	61,400-175,000
	4	185,000-266,200
	5	274,400-431,000
	6	547,900-913.600
Tobacco Space (units)	1	0-2,500
	2	3,000-4,500
	3	5,000-6,500
	4	7,500-8,700
	5	9,000-13,000
Dairy Potential (cows)	2	1-10
	3	11-20
	4	21-30
	5	31-40
Observed Income (dollars)	1	(528)-2,145
	2	2,215-2,660
	3	3,375-5,540
	4	6,475-9,455
	5	11,220-25,400
Potential Income (dollars)	1	766-3135
	2	3,540-5,960
	3	6,290-7,970
	4	10,970-11,470
	5	13,720-18,870
	6	20,400-29,915

(Table C-2). Groups were then formed on the basis of this unique index by categorizing farms by:

Group 1 = index 2.0 - 6.5

Group 2 = index 7.0 - 12.0

Group 3 = index 13.5 - 17.0

Group 4 = index 17.5 - 29.0

Table C-3 indicates the grouping of farms as well as the quantity of resources and income making ability used in determining the farm groups.

TABLE C-2. Ranking and Deviation of Determining Indices

Farm Identification	Decision Variables: Land/ Labor	Tobacco Space	Dairy	Observed Income	Potential Income	Composite Index
1	5+	2-	0	2	2	11.0
2	5-	2-	0	2	2-	9.5
3	4+	1	0	3+	2+	11.5
4	3	3-	0	3-	2	10.0
5	3+	2+	0	3	2	11.0
6	2	1	0	1	1	5.0
7	4-	3-	0	3	5-	13.5
8	2	2-	0	2	1	6.5
9	2+	1+	0	1+	1	6.5
10	4-	1	0	1-	2	7.0
11	1	1	0	1	2-	4.5
12	2	1-	0	1-	1-	3.5
13	6+	3	0	2	3	14.5
14	3	4+	0	3+	3+	14.5
15	1	4	0	4-	3	11.5
16	4-	4	0	4-	3	14.0
17	3+	5-	0	4-	3	14.5
18	4	3-	0	3	2+	12.0
19	3	3	3	4+	4	17.5
20	3-	1	0	3+	2+	9.5
21	5-	1	0	1+	2-	8.5
22	2-	1	0	1	1	4.5
23	5	5	4	5	5-	23.5
24	3	2+	0	3	2+	11.0
25	2	2-	2	3-	3-	10.5
26	3	1+	2	3-	3-	11.5
27	2-	2+	0	1	2-	6.5
28	6+	3+	3	5	5+	23.5
29	2-	1+	0	1	1	5.0
30	6+	5+	5	5+	6+	29.0
31	6	3+	3	5+	6+	24.5
32	1-	1-	0	1-	1-	2.0
33	4	5	0	4	4	17.0
34	4+	4	3	5	5-	21.0
35	5+	4	3	5	5	22.5
36	3+	5	0	3	3	14.5
37	4-	2	0	1+	2	9.0
38	3	1-	0	1	1	5.5
39	3-	]	0	1	1	6.5
40	1-	1	0	1-	1-	2.5

TABLE C-3. Resources and Income Ability Measure of Farm Groups

Farm I.D.	Variables						
			LXL	Tobacco	Dairy	Income	
	Labor	Land	Index	Space	Potential	Observed	Potential
	(hours)	(units)	(000)	(units)	(cows)	($000)	
				Group 1			
6	1,170	32	37	2,000	0	1.5	2.6
8	2,340	21	50	3,000	0	2.2	2.9
9	2,340	24	57	2,250	0	1.6	2.9
11	2,340	4	16	1,400	0	1.1	4.2
12	2,340	21	49	1,050	0	(.5)	.9
22	2,340	10	23	2,000	0	1.1	2.8
27	2,820	10	28	4,550	0	1.5	3.5
29	600	54	32	2,500	0	1.6	2.8
32	375	30	11	750	0	.7	.8
38	1,550	55	85	750	0	1.5	2.2
39	2,365	26	61	4,000	0	1.1	3.1
40	2,340	2	9	1,300	0	1.0	1.1
				Group 2			
1	2,987	84	335	3,000	0	2.2	5.0
2	2,565	100	274	3,000	0	2.7	3.7
3	1,575	169	266	1,800	0	5.5	5.8
4	2,640	49	129	5,000	0	3.8	5.2
5	2,340	60	140	4,500	0	4.1	4.3
10	2,340	80	187	2,000	0	.4	5.3
15	2,640	3	18	8,300	0	6.6	7.0
18	3,383	62	210	5,000	0	4.6	5.6
20	7,496	10	71	1,320	0	5.5	6.0
21	2,471	113	279	1,500	0	2.1	4.0
24	2,340	62	144	4,500	0	4.0	5.7
25	1,358	35	48	3,000	10	3.7	6.3
26	2,850	38	107	2,500	10	3.4	6.6
37	2,765	69	191	4,000	0	1.7	4.8

TABLE C-3 (continued)

Farm I.D.	Variables						
	Labor (hours)	Land (units)	LXL Index (000)	Tobacco Space (units)	Dairy Potential (cows)	Income Observed ($000)	Income Potential ($000)
				Group 3			
7	2,640	72	189	5,000	0	4.6	14.2
13	8,085	101	813	5,520	0	2.4	6.9
14	4,980	23	112	8,680	0	8.4	9.2
16	2,846	65	185	7,500	0	6.5	8.0
17	3,195	48	152	9,000	0	6.8	8.0
33	2,340	72	214	10,000	0	8.1	11.0
36	3,232	54	175	9,600	0	4.3	7.5
				Group 4			
19	2,903	45	131	5,100	20	9.5	11.5
23	3,240	93	302	11,000	30	13.1	13.7
28	4,680	190	889	6,200	20	13.7	18.9
30	6,658	115	766	13,000	40	25.4	29.0
31	5,591	98	548	6,000	20	20.7	20.7
34	2,390	97	132	7,500	20	11.2	15.0
35	3,489	124	431	7,500	20	12.4	15.3

APPENDIX D

TABLE D-1. Observed Available Resources, by Farm and Group Average

Farm Identification	Building Capacity			Land (acres)				Labor (man-hrs)		Tobacco Quota Base
				Owned		Rented-in		Peak Two-Month Period	Annual Total	
	Tobacco (lbs)	Hay (bales)	Silage (tons)	Crop	Permanent Pasture	Crop	Permanent Pasture			
6	2,000	1,000	0	25	14	0	0	260	1,170	2,000
8	3,000	2,500	0	16.5	8.5	0	0	520	2,340	2,500
9	2,250	700	0	19	11	0	0	520	2,340	1,200
11	1,400	0	0	7	0	0	0	520	2,340	1,300
12	2,100	3,500	0	0	0	23	30	520	2,340	2,100
22	2,000	0	0	10	0	0	0	520	2,340	1,600
27	3,500	200	0	9.5	0	1	0	720	2,820	447
29	5,000	1,000	0	54	0	0	0	100	600	2,400
32	1,500	0	0	5	50	0	0	75	375	1,500
38	4,500	3,000	0	50	10	0	0	345	1,550	3,300
39	4,000	0	0	22	8	0	0	595	2,365	1,000
40	1,300	0	0	4	0	0	0	520	2,340	1,200
Avg.- Group 1	2,713	992	0	18.5	8.5	2.0	2.5	435	1,910	1,712
1	3,000	2,500	180	80	8	0	0	913	3,987	2,600
2	6,000	5,000	0	107	0	0	0	520	2,565	2,873
3	1,800	11,000	200	155	0	0	0	350	1,575	1,400
4	5,000	1,000	75	35	28	0	0	720	2,640	3,500
5	4,500	2,000	0	41	38	0	0	520	2,340	1,700
10	2,000	2,600	0	32	19	77	0	520	2,340	1,250
15	8,300	0	0	6.5	0	0	0	720	2,640	3,300
18	5,000	6,500	0	45	34	0	0	870	3,383	2,400
20	5,800	0	0	0	0	18.5	0	1,665	7,496	1,500
21	3,000	3,500	0	92	42	0	0	570	2,471	3,000
24	4,500	2,000	200	40	43	0	0	520	2,340	2,920
25	3,000	3,000	0	35	0	0	0	335	1,358	1,700
26	2,500	500	0	35	5	0	0	640	2,850	1,458
37	4,000	2,000	0	69	0	0	0	720	2,820	2,000
Avg. - Group 2	4,171	2,971	47	55.2	15.5	6.8	0	685	2,915	2,257

TABLE D-1 (continued)

Farm Identification	Building Capacity: Tobacco (lbs)	Building Capacity: Hay (bales)	Building Capacity: Silage (tons)	Land (acres): Owned: Crop	Land (acres): Owned: Permanent Pasture	Land (acres): Rented-in: Crop	Land (acres): Rented-in: Permanent Pasture	Labor (man-hrs): Peak Two-Month Period	Labor (man-hrs): Annual Total	Tobacco Quota Base
7	5,000	4,000	0	67	8	1	0	720	2,640	1,248
13	2,400	3,000	0	17	10	152	30	1,910	8,085	550
14	4,000	0	0	13	4	15	0	1,240	4,980	2,000
16	7,500	3,000	0	65	0	0	0	845	2,846	4,000
17	9,000	2,000	0	45	5	0	0	845	3,195	3,000
33	10,000	4,000	0	46.5	40	9	0	771	2,340	6,000
36	10,000	0	0	23.5	41.5	6.5	23.5	640	3,232	4,300
Avg.-Group 3	6,843	2,285	0	40	15.5	26.2	7.6	996	3,903	3,014
19	5,000	4,100	120	45	0	0	0	745	2,903	2,600
23	11,000	3,500	300	54	50	23	17	820	3,240	4,000
28	6,500	4,500	1,000	190	0	0	0	1,040	4,680	4,600
30	13,000	600*	650	94	0	84	0	1,671	6,658	8,400
31	6,000	3,000	200	93	10	0	0	1,118	5,591	2,700
34	13,000	3,000	300	73	11	18	39	520	2,390	8,000
35	7,500	300	200	107	33	0	0	932	3,489	5,000
Avg.-Group 4	8,857	2,714	396	94	15	18	8	978	4,136	5,043

APPENDIX E

TABLE E-1. Quota Rental Rates for Counties Within Study Area

County	Rental Rate (¢/lb.)
Carter	$.10
Cocke	.15
Grainger	.20
Greene	.25
Hamblen	.19
Hancock	.27
Hawkins	.20
Jefferson	.20
Johnson	.13
Sullivan	.13
Unicoi	.20
Washington	.20

Source: Luther H. Keller and James Culver "Lease and Transfer of Burley Tobacco Quota Between Farms." *Tennessee Farm and Home Science* Progress Report 100, October, November, December, 1976. The University of Tennessee Agricultural Experiment Station.

APPENDIX F

TABLE F-1. Hourly Labor Requirements for Crop and Livestock Enterprises

Enterprise	J-F	M-A	M-J	J-A	S-O	N-D	Annual
Burley Tobacco (acre)	10	7.8	46.4	23	90.8	159.8	337.8
Silage (acre):							
Harvesting (equip. owned)		1.1	1.1	.4	2.5		5.1
Custom harvested		1.1	1.1	.4	.3		2.9
Pasture silage (equip. owned)			3		1.1	.5	5.0
Grain Corn (acre):							
Harvesting (equip. owned)		3	2	1	2	1	9
Custom harvested		3	2	1	.5	.5	7
Oats (acre)			1	.2		1.4	2.6
Wheat (acre)			1	.2		1.4	2.6
Hay (acre):							
Baling (equip. owned)			2.6	3.1			5.7
Custom baled			1.6	2.1			3.7
Oat Hay			3.5		2.1		5.6
Pasture (acre)			.5	.8			1.3
Vegetable (acre):							
Tomato		23.8	97.2	524		.8	645.8
Snap Beans	.5	19.5	70				90
Potato	2	2.5	30.5	40	10		85
Cantelope	2	5.9	61.8				69.7
Watermelon	.6	4.6		81			86.2
Livetock:							
Dairy (animal unit)	18	17	15	15	17	18	100
Cow/Calf (animal unit)	27	1.4	.7	.7	1.4	1.9	8.8
Feeder Pigs (sow unit)	4.4	3.8	3.8	4.3	3.8	3.9	24
Broilers (1000 birds)	4	3	4	3	4	4	22
Hogs (animal unit)	.2	.2	.2	.2	.2	.2	1.2

TABLE F-1 (continued)

Sources: Thomas H. King. "An Economic Analysis of the Production, Packaging and Marketing Potentials of Fresh Vegetables in Claiborne County, Tennessee." Unpublished Master's Thesis, University of Tennessee, Knoxville, Tennessee, December 1977. Pp. 97, 112; Robert M. Ray and Herbert N. Welch. "Farm Planning Manual." Agricultural Extension Service, University of Tennessee, Knoxville, Tennessee, (Revised) 1978. Pp. 5, 6; Daniel B. Smith, G. Ansel King, and Dan O. Ezell. "Selected Vegetable Budgets, South Carolina, 1976." Bulletin AE 390, Department of Agricultural Economics and Rural Sociology, Clemson University, Clemson, South Carolina, 1976. Pp. 7, 13, 21.; Fred J. Stewart. "Potential for Increased Net Incomes on Small Farms in Four Eastern Kentucky Counties." Unpublished Dissertation, University of Kentucky, Lexington, Kentucky, 1975. Pp. 146, 155.

APPENDIX G

Table G-1. Enterprise Budget for Burley Tobacco.

Item	Unit	Quantity	Price	Amount (Own)	Amount (Rent-In) (50/50 share)	Amount (Rent-Out) (50/50 share)
Revenue:						
Gross Revenue - tobacco	lb	2400	$ 1.13	$2712	$1356	$1356
Expenses:						
Variable:						
Plant Bed	--	--	--	78	78	--
Fertilizer:						
5-10-15	cwt	19	5.80	110	--	110
Nitrogen	lb	80	.20	16	--	16
Lime	ton	.40	8.00	3	--	3
Insecticide - Sevin 50% W.P.	lb	6	1.45	9	9	--
Sucker Control - MH-30	gal	1.25	10.90	14	14	--
Machinery:						
Tractor	hr	20.20	2.01	41	41	--
Other	--	--	--	9	9	--
Hauling	cwt	24	.75	18	9	9
Market Fees @ 5% + $1.25 cwt	cwt	24	--	173	87	87
Total variable expenses				$ 471	$ 247	$ 225
Fixed:						
Tobacco sticks (prorated over 8 yrs.)	acre	2100	.12	31	--	31
Machinery						
Tractor	hr	20.20	1.39	28	28	--
Other	--	--	--	25	25	--
Barn - depreciation/repairs	--	--	--	180	--	180
Total fixed expenses				$ 264	$ 53	$ 211
Total variable and fixed expenses				$ 735	$ 300	$ 436
Net return to land, labor, capital, and management				$1977	$1056	$ 920

Table G-2. Enterprise Budget for Grain Corn on Land Owned.

Item	Unit	Quantity	Price	Amount (Equip. Own)	Amount (Cust. Harv.)
Revenue:					
Gross Revenue:					
from rotation land corn	bushel	70	$ 2.60	$ 182	$ 182
from bottom land corn	bushel	80	2.60	208	208
Expenses:					
Variable:					
Seed -- 12-14 thousand plants	bushel	.2	45.00	9	9
Fertilizer:					
N	lb	90	.20	18	18
P_2O_5	lb	50	.16	8	8
K_2O	lb	50	.09	5	5
Boron	lb	1	1.20	1	1
Lime	ton	.40	8.00	3	3
Weed Control -- Arazine	lb	2.50	2.47	6	6
Machinery:					
Tractor	hr	1.88	3.19	6	5
Combine	hr	.40	10.35	4	--
Truck	hr	.40	4.61	2	2
Other				3	2
Custom Harvest	acre	1	20.00	--	20
		Total variable expenses		$ 65	$ 79
Fixed:					
Machinery:					
Tractor	hr	1.88	2.13	4	4
Combine	hr	.40	20.29	8	--
Truck	hr	.40	3.78	2	2
Other	--	--	--	6	4
			Total fixed expenses	$ 19	$ 10
			Total variable and fixed expenses	$ 84	$ 89
Net return to land, labor, capital, and management (rotation land)				$ 98	$ 93
Net return to land, labor, capital, and management (bottom land)				$ 124	$ 119

Table G-3. Enterprise Budget for Grain Corn on Land Rented.

Item	Unit	Quantity	Price	Amount (Rent-In) (Equip. Own)	Amount (Rent-In) (Cust. Harv.)	Amount (Rent-Out) (50/50 share)
Revenue:						
Gross Revenue -- Corn	bushel	(1/2) 70	$ 2.60	$ 91	$ 91	$ 91
Expenses:						
Variable:						
Seed -- 12-14 thous. plants	bushel	(1/2) .2	45.00	5	5	5
Fertilizer:						
N	lb	(1/2) 90	.20	9	9	9
P_2O_5	lb	(1/2) 50	.16	4	4	4
K_2O_5	lb	(1/2) 50	.09	2	2	2
Boron and Lime	--	--	--	--	--	4
Weed Control -- Atrazine	lb	(1/2) 2.5	2.47	3	3	3
Machinery:						
Tractors	hr	1.88	3.19	6	5	--
Combine	hr	.40	10.35	4	--	--
Truck	hr	(1/2) .40	4.61	1	1	1
Other	hr	--	--	3	2	--
Custom Harvest	acre	1	20.00	--	20	--
	Total variable expenses			$ 37	$ 51	$ 28
Fixed:						
Machinery:						
Tractor	hr	1.88	2.13	4	4	--
Combine	hr	.40	20.90	8	2	--
Truck	hr	.20	3.78	1	4	--
Other	--	--	--	6	--	--
	Total fixed expenses			$ 19	$ 10	--
	Total variable and fixed expenses			$ 56	$ 61	$ 28
Net return to land, labor, capital, and management				$ 35	$ 30	$ 63

Table G-4. Enterprise Budget for Corn Silage.

Item	Unit	Quantity	Price	Amount Land: (Own) Equip: (Own)	Amount (Own) (Custom)	Amount (Rent-In) (Own) (50-50 share)
Revenue:						
Gross Revenue:						
Sileage (bottomland)	ton	14	$ 16.65	$ 233	$ 233	$ 117
Sileage (rotation land) (Assumed marketable for budgetary purposes)	ton	12	16.65	200	200	--
Expenses:						
Variable:						
Seed	bu	.3	45.00	14	14	7
Fertilizer:						
N	lb	120	.20	24	24	12
P_2O_5	lb	80	.16	13	13	7
K_2O	lb	150	.09	14	14	7
Boron	lb	1	1.20	1	1	1
Lime	ton	.5	8.00	4	4	--
Weed Control-Atrazine	lb	2.5	2.47	6	6	3
Machinery:						
Tractor	hr	4.6	3.77	17	7	17
Forage Harvester	hr	1.0	5.20	5	--	--
Other	acre	1.0		10	5	10
Custom Harvest	acre	1.0	45.00	--	45	--
		Total variable expenses		$ 108	$ 133	$ 69
Fixed:						
Machinery:						
Tractor	hr	4.6	2.39	11	5	11
Forage Harvester	hr	1.0	9.03	9	--	9
Other	--	--	--	24	13	24
			Total fixed expenses	$ 44	$ 18	$ 44
			Total variable and fixed expenses	$ 152	$ 151	$ 113
Net return to land, labor, capital, and management (bottomland)				$ 81	$ 82	$ 4
Net return to land, labor, capital, and management (rotation land)				$ 48	$ 49	--

Table G-5. Enterprise Budget for Small Grain/Pasture Silage on Land Owned (Equipment Owned).

Item	Unit	Quantity	Price	Amount
Revenue:				
Gross Revenue				
Sileage (assumed marketable for budgetary purposes)	ton	7.5	$ 16.65	$ 125
Expenses:				
Variable:				
Seed (wheat)	bu	1.5	7.55	11
Fertilizer:				
N	lb	75	.20	15
P_2O_5	lb	60	.16	10
K_2O	lb	60	.09	5
Lime	ton	.4	8.00	3
Machinery:				
Tractor	hr	3.50	3.77	13
Forage Harvester	hr	1.00	5.20	5
Other	--	--	--	6
		Total variable expenses		$ 68
Fixed:				
Machinery:				
Tractor	hr	3.50	2.39	8
Forage Harvester	hr	1.00	9.03	9
Other	--	--	--	12
			Total fixed expenses	$ 29
			Total variable and fixed expenses	$ 97
		Net return to land, labor, capital, and management		$ 28

Table G-6. Enterprise Budget for Wheat.

Item	Unit	Quantity	Price	Amount (Own)	Amount (Rent-In) (50-50 share)
Revenue:					
Gross Revenue -- Wheat Grain	bu	29	$ 3.05	$ 88	$ 44
Expenses:					
Variable:					
Seed	bu	1.50	7.55	11	6
Fertilizer:					
N	lb	50	.20	10	5
P_2O_5	lb	50	.16	8	4
Lime	lb	30	.09	3	2
Machinery:					
Tractor	hr	1.20	2.80	3	3
Combine	hr	.50	7.75	4	4
Truck	hr	.50	4.61	2	1
Other	--	--	--	1	1
			Total variable expenses	$ 44	$ 26
Fixed:					
Machinery:					
Tractor	hr	1.20	1.85	2	2
Combine	hr	.50	15.69	8	8
Truck	hr	.50	3.78	2	2
Other	--	--	--	4	4
			Total fixed expenses	$ 16	$ 16
			Total variable and fixed expenses	$ 60	$ 42
			Net return to land, labor, capital, and management	$ 28	$ 2

Table G-7. Enterprise Budget for Oats.

Item	Unit	Quantity	Price	Amount (Own)	Amount (Rent-In) (50-50 share)
Revenue:					
Revenue -- grain	bu	45	$ 1.80	$ 81	$ 41
-- straw	bale	--	--	--	20
			Total gross revenue	$ 81	$ 61
Expenses:					
Variable:					
Seed	bu	2	4.40	9	5
Fertilizer:					
N	lb	50	.20	10	5
P_2O_5	lb	50	.16	8	4
K_2O	lb	30	.09	3	1
Lime	ton	.4	8.00	2	1
Machinery:					
Tractors	hr	1.2	2.80	3	6
Combine	hr	.5	7.75	4	4
Truck	hr	.5	4.61	2	1
Other	--	--	--		5
			Total variable expenses	$ 42	$ 32
Fixed:					
Machinery:					
Tractor	hr	1.2	1.85	2	4
Combine	hr	.5	15.69	8	8
Truck	hr	.5	3.78	2	2
Other	--	--	--	4	13
			Total fixed expenses	$ 16	$ 27
			Total variable and fixed expenses	$ 58	$ 59
			Net return to land, labor, capital, and management	$ 23	$ 2

Table G-8. Enterprise Budget for Hay.

Item	Unit	Quantity	Price	Amount	
				Equip. Own[a]	Custom Bale
Revenue:					
Gross Revenue -- 2 cuttings/year	ton	2.0	$ 41.00	$ 82	$ 82
Expenses:					
Establishment Cost:					
Seed (Timothy and Red Clover)	lb	21	1.50	32	32
Fertilizer (N, P_2O_5, K_2O)				29	29
Lime	ton	2	8.00	16	16
Machinery				14	14
		Total Establishment Cost		$ 91	$ 91
Variable:					
Fertilizer:					
P_2O_5	lb	45	16.00	7	7
K_2O	lb	45	.09	4	4
Twine	bale	90	.04	4	--
Machinery:					
Tractor	hr	4.4	2.80	12	8
Baler	hr	1.4	5.11	7	--
Other	--	--	--	6	6
Custom Baling	--	--	--	--	27
		Total variable expenses		$ 40	$ 52
Fixed:					
Establishment Cost (prorated over 4 yrs)	--	--	--	23	23
Machinery:					
Tractor	hr	4.4	1.85	8	5
Baler	hr	1.4	10.91	15	11
Other	--	--	--	12	--
			Total fixed expenses	$ 58	$ 39
			Total variable and fixed expenses	$ 98	$ 91
			Net return to land, labor, capital, and management	$-16	$- 9

Hay (equipment owned) or land rented-in has the same budgeted revenue and expenses except an additional $30 cash rent/acre.

Table G-9. Enterprise Budget for Oat Hay.

Item	Unit	Quantity	Price	Amount
Revenue:				
Gross Revenue -- Hay	ton	2.0	$ 45.00	$ 90
Expenses:				
Variable:				
Seed	bu	2	4.40	9
Fertilizer:	lb	75	0.20	15
P_2O_5	lb	60	0.16	10
K_2O	lb	60	0.09	5
Lime	ton	0.4	8.00	3
Twine	bale	100	0.04	4
Machinery:				
Tractor	hr	3.3	2.80	9
Baler & Thrower	hr	0.7	5.11	4
Other	--	--	--	4
			Total variable expenses	$ 63
Fixed:				
Machinery:				
Tractor	hr	3.3	1.85	6
Baler and Thrower	hr	0.7	10.90	8
Other	--	--	--	10
			Total fixed expenses	$ 24
			Total variable and fixed expenses	$ 87
			Net return to land, labor, capital, and management	$ 3

Table G-10. Enterprise Budget for Pasture.

Item	Unit	Quantity	Price	Amount
Revenue:				
Pasture on cropland -- 2489 TDN	Hay Eq.	2.90	$ 41.00	$119
Pasture on permanent pasture -- 1645 TDN	Hay Eq.	1.90	41.00	78
Expenses:				
Establishment Cost:				
Seed (Clover/Fescue)	lb	2/12	2.50/.40	10
Fertilizer (N, P_2O_5, K_2O)	--	--	--	29
Lime	ton	2	8.00	16
Tractor	hr	2.05	4.65	9
Other Machinery	--	--	--	7
		Total establishment cost		$ 71
Variable:				
Fertilizer				
N	lb	14	.20	3
P_2O_5	lb	45	.16	7
K_2O	lb	45	.09	4
Machinery:				
Tractor	hr	1	2.80	3
Other	--	--	--	1
				$ 18
Fixed:				
Establishment Cost (prorated over 10 years)	--	--	--	7
Overseeding Cost	--	--	--	2
Tractor	hr	1	1.85	2
			Total fixed expenses	$ 11
			Total variable and fixed expenses	$ 29
			Net return to land, labor, capital, and management (rotation land)	$ 90
			Net return to land, labor, capital, and management (permanent pasture)	$ 49

Pasture on land rented-in has the same budgeted revenue and expenses except an additional $30 cash rent/acre.

The following are yields of TDN per acre in specific time periods.

Time Period	Pasture on Rotation Land	Permanent Pasture
Nov-Feb	204	140
Mar	263	181
Apr-May	1076	740
Jun-Aug	467	321
Sept-Oct	382	263
Annual	2392	1645

The following are transfer rates of TDN to the following month:

Month Transferred	Rate Transferred
Jan-Mar	95%
Apr	90%
May	70%
June	60%
July	70%
Aug	80%
Sept-Dec	95%

Table G-11. Enterprise Budget for Late Staked Tomatoes.

Item	Unit	Quantity	Price	Amount
Revenue:				
Gross Revenue:				
1's and 2's	lb	25,000	$ 0.13	$ 3,250
Salvage	lb	10,000	0.06	600
			Total Gross Income	$3,850
Expenses:				
Variable:				
Plants - 1"	thous.	5	25.00	125
Fertilizer: N	lb	60	0.22	13
P_2O_5	lb	160	0.18	29
K_2O	lb	240	0.11	27
Side Dress	lb	90	0.22	20
Lime	ton	1	7.25	7
Chemicals:				
Insecticide: Sevin 50% W.P.	lb	48	1.98	95
Furgicide: Maneb	lb	10	1.24	12
Bravo	pt	14	3.62	51
Hebicide: Diphenamid	lb	12	2.21	27
Tractor - 60 HP	hr	25	2.80	69
Truck - 2 ton	hr	7	4.61	30
Other	--	--	--	15
Packing Charges:				
Twine	lb	200	.29	58
Box - 20# size, 30# size	each	1500	.37	555
Decals	each	1500	.12	180
Packing Shed Fees (Box)	each	1500	.53	795
Broker Fee - 5% of $3,250	--	--	--	163
			Total variable expenses	$2,271
Fixed:				
Stakes	thous.	1.08	100.00	108
Containers	each	33	0.75	25
Machinery:				
Tractor - 60 HP	hr	24.60	1.85	46
Truck - 2 ton	hr	6.50	3.78	25
Other	--	--	--	25
			Total fixed expenses	$ 229
			Total variable and fixed expenses	$2500
			Net return to land, labor, capital, and management	$1350

Tomatoes on land rented-in have the same budgeted revenue and expenses except an additional $60 cash rent/acre.

Table G-12. Enterprise Budget for Fresh Market Snap Beans.

Item	Unit	Quantity	Price	Amount
Revenue:				
Gross Revenue (bushel - 30#)	bushel	133	$ 4.00	$ 532
Expenses:				
Variable:				
Seed	lb	80	1.25	100
Fertilizer:				
N	lb	45	0.22	10
P_2O_5	lb	60	0.18	11
K_2O	lb	30	0.11	3
Chemicals:				
Insecticide: Sevin 50% W.P.	lb	10	1.96	20
Thiodan 50% W.P.	lb	6	6.70	40
Fungicide: Maneb	lb	10	1.24	12
Terraclor	lb	2	1.49	3
Herbicide: Epte	lb	2.5	2.97	7
Machinery:				
Tractor	hr	10	2.80	28
Truck	hr	4	4.61	18
Other	--	--	--	2
Packing Charges:				
Containers -- bushel	cash	133	0.90	120
Broker Fees -- 5% of $532	--	--	--	26
			Total variable expenses	$ 400
Fixed:				
Machinery				
Tractor	hr	10	1.85	19
Truck	hr	4	3.78	15
Other	--	--	--	13
			Total fixed expenses	$ 47
			Total variable and fixed expenses	$ 447
			Net return to land, labor, capital, and management	$ 85

Snap beans on land rented-in have the same budgeted revenue and expenses except an additional $60 cash rent/acre.

Table G-13. Enterprise Budget for Potatoes.

Item	Unit	Quantity	Price	Amount
Revenue:				
Gross Revenue - Potatoes	cwt	95	$ 5.95	$ 565
Expenses:				
Variable:				
Seed	cwt	18	6.00	108
Fertilizer 5-10-10	ton	1	100.00	100
Nitrogen	cwt	2	6.70	13
Lime	ton	.25	8.00	2
Insecticide	acre	1	15.00	15
Fungicide	acre	1	5.00	5
Herbicide	acre	1	14.00	14
Machinery & Tractor	acre	1.27	5.50	7
Container - 1 bu.	each	190	.50	95
Containers, used	each	350	.25	88
Brokerage	bu	290	.25	73
Harvesting - Machinery & Tractor	acre	1	6.00	6
			Total variable expenses	$526
Fixed:				
Machinery and Tractors	acre	1	16.00	16
			Total fixed expenses	$ 16
			Total variable and fixed expenses	$542
		Net return to land, labor, capital, and management		$ 23

Table G-14. Enterprise Budget for Watermelons.

Item	Unit	Quantity	Price	Amount
Revenue:				
Gross Revenue -- Watermelons	cwt	250	$ 2.50	$ 625
Expenses:				
Variable:				
Seed	lb	2	5.50	11
Fertilizer 6-12-12	cwt	10	5.75	58
Side Dress	cwt	1.25	6.50	8
Herbicide	qt	2.75	2.95	8
Fungicide	lb	5	1.07	5
Insecticide	lb	2	3.00	6
Spraying	acre	5	2.00	10
Tractors	acre	1.90	2.80	5
Other Machinery	acre	3.17	1.00	3
Marketing	acre	1	17.00	17
			Total variable expenses	$131
Fixed:				
Machinery and Tractors	acre	1	10.00	10
			Total fixed expenses	$ 10
			Total variable and fixed expenses	$141
		Net return to land, labor, capital, and management		$484

Table G-15. Enterprise Budget for Cantaloupe.

Item	Unit	Quantity	Price	Amount
Revenue:				
Gross Revenue -- Cantelope	cwt	125	$ 7.00	$ 875
Expenses:				
Variable:				
Seed	lbs	3	2.50	8
Lime	ton	.33	16.50	5
Fertilizer	cwt	10	5.75	58
Side Dress 14-0-14	cwt	2	6.50	13
Herbicide	qt	3.75	2.94	11
Fungicide	lb	5	1.07	5
Nematicide	lb	9	.33	3
Insecticide	lb	2	3.00	6
Spraying	acre	5	2.00	10
Containers 1.1 bu.	container	250	.80	200
Machinery	acre	1	13.00	13
Tractors	acre	3.10	2.80	9
Other				6
			Total variable expenses	$347
Fixed:				
Machinery and Tractors	--	--	--	30
			Total fixed expenses	$ 30
			Total variable and fixed expenses	$ 377
		Net return to land, labor, capital, and management		$ 498

Table G-16. Enterprise Budget for Cow-Calf Operation (Cow Unit/1.7 Animal Units).

Item	Unit	Quantity	Price	Amount
Revenue:				
Feeder Calves -- .43 Steer @ 510#	lbs	221	$ .33	$ 73
-- .3 Heifer @ 465#	lbs	140	.29	40
Cull Cows (-2% death loss) -- .166 @ 900#	lbs	150	.24	35
		Total gross revenue		$148
Expenses:				
Variable:				
Feed:				
Mineral and Salt	head	1.17	1.25	1
Hay (1.24 tons intermediate product)	TDN	1064	--	--
Pasture (1.5 acres intermediate product)	TDN	2497	--	--
Other TDN (hay, sileage, corn, pasture)	TDN	1302	--	--
Veterinary and Medicine	head	1	7.90	8
Marketing	head	.90	11.37	10
Machinery (truck and tractor)	head	.90	3.00	3
		Total variable expenses		$ 22
Fixed:				
Depreciation/repairs on bldgs. and equip.	head	1	2.57	3
Depreciation/repairs on fences	head	1	3.18	3
Depreciation on bull	head	1	3.29	3
Tractor	hr	1.3	1.00	2
		Total fixed expenses		$ 11
		Total variable and fixed expenses		$ 33
		Net return to land, labor, capital, and management		$115

Table G-17. Enterprise Budget for Manufactured Milk Dairy (Cow Unit/1.4 Animal Units).

Item	Unit	Quantity	Price	Amount
Revenue:				
Milk -- 4% b.f.	cwt	770	$ 8.00	$ 616
Calves	head	.5	20.00	10
Cull cows @ $27	head	.2	324.00	65
Non-bred heifers @ $.30	head	.2	240.00	48
			Total gross revenue	$ 739
Expenses:				
Variable:				
Dairy Feed:				
16% concentrate (corn portion included below)	lb	480	.20	96
Corn (45 bu. intermediate product)	TDN	2025	--	--
TDN (intermediate product -- sileage, hay or pasture)	TDN	6240	--	--
Breeding Fur	cow	1.4	9.00	13
Bedding	cow	1	4.00	4
Hauling (milk)	cwt	77	.45	35
Veterinary and Medicine	cow	1.4	4.00	6
Dairy Supplies	cow	1.0	2.50	3
Electricity	kwh	100	.03	3
Tractor	hr	2	1.17	2
Other	--	--	--	15
			Total variable expenses	$177
Fixed:				
Depreciation/repairs of bldgs. and equip.	--	--	--	35
Depreciation/repairs of fences	--	--	--	6
Tractor	--	--	--	3
			Total fixed expenses	$ 44
			Total variable and fixed expenses	$221
			Net return to land, labor, capital, and management	$518

Table G-18. Enterprise Budget for Feeder Pig Operation (Sow Unit with 2 Litters).

Item	Unit	Quantity	Price	Amount
Revenue:				
Feeder Pigs (45# @ $.73/#)	head	15.50	$ 32.85	$ 509
Cull Sows (450# @ $.29/#)	head	.50	130.00	65
		Total gross revenue		$ 574
Expenses:				
Variable:				
Feed:				
Supplement	cwt	7.25	11.00	80
Creep Feed -- 32%	cwt	.80	10.00	80
Corn (44.6 bu. intermediate product)	TDN	2007	--	--
Pasture (.4 acres intermediate product)	TDN	657	--	--
Marketing (pigs and sows)	head	15.50	.75	12
Veterinary and Medicine	head	1	13.80	14
Grind and Mix	cwt	23.46	.45	11
Electricity	sow	1	5.00	5
Machinery (truck and tractor)	--	--	--	4
		Total variable expenses		$206
Fixed:				
Depreciation/repairs on bldgs. and equip.	--	--	--	21
Repairs on fences	--	--	--	2
Depreciation on boar	--	--	--	8
			Total fixed expenses	$ 31
			Total variable and fixed expenses	$237
			Net return to land, labor, capital, and management	$337

Table G-19. Enterprise Budget for Hog Operation (Animal Unit).

Item	Unit	Quantity	Price	Amount
Revenue:				
Market Hog	cwt	2.3	$ 42.60	$ 98
-Death Loss- 3%	--	--	--	(3)
			Total gross revenue	$ 95
Expenses:				
Variable:				
Feeder Pig - 45 lbs.	head	1	25.00	25
Corn (9.7 bu. intermediate product)	TDN	937	--	--
Supplement	cwt	1.15	10.50	12
Premix	cwt	.17	14.50	2
Veterinary and Medicine	head	1	1.65	2
Truck -- 40 mile haul	head	1	1.00	1
Grind and Machinery	cwt	6.77	.22	2
			Total variable expenses	$ 44
Fixed:				
Repairs and Depreciation on bldgs. & equip.	head	1	2.00	2
			Total fixed expenses	$ 2
			Total variable and fixed expenses	$ 46
			Net return to land, labor, capital, and management	$ 49

Table G-20. Enterprise Budget for Broilers on Contract (1,000 Birds).

Item	Unit	Quantity	Price	Amount
Revenue:				
Broilers	thous.	1	$ 98.00	$ 98
-2% mortality	thous.	.02	98.00	(2)
			Total gross revenue	$ 96
Expenses:				
Fuel	thous.	1	11.96	12
Electricity	thous.	1	2.49	2
Miscellaneous	thous.	1	3.74	4
Litter	thous.	1	5.00	5
Insurance	thous.	1	3.74	4
			Total variable expenses	$ 27
Fixed:				
Machinery:				
Bldg. depreciation - 4% of $19,820/80	--	--	--	10
Bldg. repairs - 1.5% of $19,820/80	--	--	--	3
Equip. depreciation - 10% of $8,800/80	--	--	--	11
Equip. repairs - 2.5% of $8,800/80	--	--	--	3
			Total fixed expenses	$ 27
			Total variable and fixed expenses	$ 54
			Net return to land, labor, capital, and management	$ 42

APPENDIX H

TABLE H-1. Observed Enterprise Combination, by Limited Resource Farm Group, Used as Bench Mark Levels in Upper East Tennessee, 1976 (Program 1 and 1A)

Enterprises and Net Income	Limited Resource Farm Group 1	2	3	4
Net Income: Short-run (dollars)	$1,319	$3,741	$5,708	$15,533
Net Income: Long-run (dollars)	488	1,381	3,506	10,707
Tobacco:				
Own (pounds)	904	2,660	4,678	5,182
Rent-in (acres)	0.143	0.08	1.2	--
Rent-out (acres)	0.143	0.125	--	0.685
Buy (pounds)	222	1,139	1,768	1,784
Sell (pounds)	317	205	--	--
Grain Corn:				
Own (acres)	.85	2.3	1.1	4.1
Rent-in (acres)	--	3.8	6.7	3.4
Rent-out (acres)	1.4	1.1	--	--
Sell (bushels)	4.8	39	207	30
Silage:				
Own (acres)	--	--	--	16.8
Rent-in (acres)	--	.6	--	8.7
Wheat:				
Own (acres)	--	--	1.4	1.9
Rent-in (acres)	--	--	2.9	--
Oats:				
Own (acres)	--	0.1	--	--
Rent-in (acres)	--	0.9	--	--
Pasture: (acres)				
Rotation land	8.7	30	19.5	48.6
Permanent Pasture	8.5	15.5	15.5	14.9
Rent-in (Rotation)	--	--	7.1	5.9
Rent-in (permanent pasture)	2.5	--	7.6	8.0
Hay:				
Own (acres)	6.1	19.9	14.4	19.4
Store/Sell (tons)	.2	1	3.1	--
Buy (tons)	1.0	1.3	1.4	--
Rent-in (acres)	1.8	1.7	6.4	--
Tomatoes:				
Own (acres)	--	--	.07	--
Rent-in (acres)	--	.14	--	--
Snap Beans: Own (acres)	0.025	--	0.5	--

TABLE H-1 (continued)

Enterprises and Net Income	Limited Resource Farm Group			
	1	2	3	4
Potatoes: Own (acres)	0.04	--	--	--
Watermelon: Own (acres	--	--	0.14	--
Cantelope: Own (acres	--	--	0.03	--
Dairy: (animal Unit)	--	0.5	--	26.4
Cow-Calf: (animal unit)	11.4	21	20.6	0.7
Feeder Pig: (sow unit)	0.1	0.3	--	--
Market Hog: (hog unit)	0.1	--	--	--
Broiler: (thousand birds)	--	--	--	14.3

TABLE H-2. Optimal Enterprise Combination, by Limited Resource Farm Group, in Upper East Tennessee, 1976: Short-Run Allowing Only Observed Enterprises on Farms to Enter Solution; Tobacco Quota Leased-In Limited to 1,575 Pounds; Hay and Corn Production Restricted as Intermediate Products Only (Program 2)

Enterprises and Net Income	Limited Resource Farm Group 1	2	3	4
Net Income: Short-run (dollars)	2,400	5,059	7,840	17,403
Enterprises:				
Tobacco:				
Own (pounds)	1,371	2,640	4,589	5,132
Rent-in (acres)	0.144	0.08	1.2	--
Rent-out (acres)	0.142	0.09	--	0.6
Buy (pounds)	565	909	1,575	1,457
Sell (pounds)	400	205	--	--
Grain corn:				
Own (acres)	1.6	2	0.3	3.7
Rent-in (acres)	--	--	1.3	12
Rent-out (acres)	0.7	0.6	--	--
Buy (bushels)	15.8	--	--	742
Silage:				
Own (acres)	--	--	--	7.1
Rent-in (acres)	--	0.33	--	--
Wheat:				
Own (acres)	--	--	6.2	4.8
Rent-in (acres)	--	--	19.7	--
Oats:				
Own (acres)	--	1.8	--	--
Rent-in (acres)	--	5.5	--	--
Pasture:(acres)				
Rotation land	10.3	31	20.5	62.9
Permanent pasture	8	15.5	14.4	6.6
Rent-in (rotation)	--	--	--	2.6
Hay:				
Own (acres)	4.8	14.6	7	1.5
Buy (tons)	1.3	--	5	5.3
Rent-in (acres)	--	--	1.3	--
Tomatoes:				
Rent-in (acres)	--	0.22	--	--
Snap Beans:				
Own (acres)	0.61	--	1.64	--
Watermelon:				
Own (acres)	--	--	0.714	--
Cantaloupe				
Own (acres)	--	--	1.3	--

TABLE H-2 (continued)

Enterprises and Net Income	Limited Resource Farm Group			
	1	2	3	4
Dairy: (animal unit)	--	1.4	--	--
Cow-Calf: (animal unit)	8.8	22.8	18	28.4
Feeder pig: (sow unit	0.83	--	--	2.4
Market hog: (hog unit)	1.25	--	--	--
Broiler:(thous. birds)	--	--	--	11

TABLE H-3. Optimal Enterprise Combination, by Limited Resource Farm Group, in Upper East Tennessee, 1976: Long-Run Allowing Only Observed Enterprises on Farms to Enter Solution; Tobacco Quota Leased-In Limited to 1,575 Pounds; Hay and Corn Production Restricted as Intermediate Products Only (Program 2A)

Enterprises and Net Income	Limited Resource Farm Group 1	2	3	4
Net Income: Long-run (dollars)	1,754	3,259	6,274	13,900
Enterprises:				
Tobacco:				
Own (pounds)	1,371	2,640	4,589	5,156
Rent-In (acres)	0.144	.08	1.2	--
Rent-Out (acres	0.138	.09	--	0.57
Sell (pounds)	400	205	--	--
Grain Corn:				
Own (acres)	0.66	1.5	0.1	7.8
Rent-In (acres)	--	--	--	8.1
Rent-Out (acres)	0.44	0.83	--	--
Buy (bushels)	16	--	--	963
Silage:				
Own (acres)	--	--	--	8.7
Wheat:				
Own (acres)	--	--	6.1	2.1
Rent-in (acres)	--	--	21.4	--
Oats:				
Own (acres)	--	2.2	--	--
Rent-in (acres)	--	5.5	--	--
Pasture: (acres)				
Rotation land	13.7	43.8	17.3	56
Permanent pasture	--	--	4.8	2.5
Hay:				
Buy (tons)	9.4	27.3	11.6	30
Tomatoes:				
Rent-in (acres)	--	0.22	--	--
Snap Beans:				
Own (acres)	0.61	--	1.64	--
Watermelon:				
Own (acres)	--	--	.829	--
Cantaloupe				
Own (acres)	--	--	1.43	--

TABLE H-3 (continued)

Enterprises and Net Income	Limited Resource Farm Group 1	2	3	4
Dairy: (animal unit)	--	1.4	--	27.3
Cow-calf (animal unit)	7.5	22.1	9.3	--
Feeder pig: (sow unit)	.83	--	--	--
Market hog: (hog unit)	1.25	--	--	--

TABLE H-4. Optimal Enterprise Combination, by Limited Resource Farm Group, in Upper East Tennessee, 1976: Short-Run Allowing Only Observed Enterprises on Farms to Enter Solution; Hay and Corn Production Restricted as Intermediate Products Only (Program 3)

Enterprises and Net Income	Limited Resource Farm Group 1	2	3	4
Net Income: Short-run (dollars)	2,491	5,383	9,090	17,666
Tobacco:				
Own (pounds)	1,613	3,076	6,787	5,907
Rent-in (acres)	.144	.08	1.1	--
Rent-out (acres)	.175	.09	--	.77
Buy (pounds)	892	1,345	3,773	2,721
Sell (pounds)	400	205	--	--
Grain Corn:				
Own (acres	.84	2	.3	3.78
Rent-in (acres)	--	--	.4	8.4
Rent-out (acres)	--	.6	--	--
Buy (bushels)	15.8	--	--	715
Silage:				
Own (acres)	--	--	--	7.9
Rent-in (acres)	--	.33	--	--
Wheat:				
Own (acres)	--	--	4.8	4.6
Rent-in (acres)	--	--	19.7	--
Oats:				
Own (acres)	--	1.8	--	--
Rent-in (acres)	--	5.5	--	--
Pasture:(acres)				
Rotation land	7.8	31	20.2	61.3
Permanent pasture	6.4	15.5	7.9	6.1
Rent-in (rotation)	--	--	--	2.6
Hay:				
Own (acres)	4.2	14.6	5.2	1.5
Buy (tons)	.58	--	5.0	4.5
Rent-in (acres)	--	--	1.2	--
Tomatoes: Rent-in (acres)	--	.22	--	--
Snap Beans: Own (acres)	.61	--	1.614	--
Watermelon: Own (acres)	--	--	.686	--
Cantaloupe: Own (acres)	--	--	1.22	--
Dairy: (animal unit)	--	1.4	--	27.3
Cow-Calf: (animal unit)	6.8	22.8	14.4	2.4
Feeder pig: (sow unit)	.83	--	--	--
Market hog: (hog unit)	1.25	--	--	--
Broiler: (thous. birds)	--	--	--	11

TABLE H-5. Optimal Enterprise Combination, by Limited Resource Farm Group, in Upper East Tennessee, 1976: Short-Run Allowing Only Observed Enterprises on Farms to Enter Solution; Allowing Hay and Tobacco Capacity to Substitute (Program 4)

Enterprises and Net Income	Limited Resource Farm Group 1	2	3	4
Net Income: Short-run (dollars)	3,768	8,600	12,904	19,218
Tobacco:				
Own (pounds)	2,136	5,360	9,332	7,346
Rent-in (acres)	.144	.08	.9	--
Rent-out (acres)	.23	.2	--	1 04
Buy (pounds)	1,567	3,903	6,319	4,804
Sell (pounds)	400	205	--	--
Grain Corn:				
Own (acres)	8.0	14.6	13.2	20.1
Rent-in (acres)	--	6.5	23.6	12.0
Rent-out (acres)	4.3	7.6	--	--
Buy (bushels)	16	--	--	678
Sell (bushels)	664	1,456	1,761	1,600
Silage: Own (acres)	--	--	--	12.4
Pasture: (acres)				
Rotation land	.23	1.8	--	26.1
Permanent pasture	5.6	5.8	8.7	10.1
Rent-in (rotation)	--	--	--	2.7
Rent-in (permanent pasture)	--	--	--	1.7
Hay				
Own (acres)	.4	1.5	0.7	--
Buy (tons)	1.4	--	2.6	--
Sell without storing (acres)	2.9	23.8	18.9	25.7
Tomatoes: Rent-in (acres)	--	.22	--	--
Snap Beans: Own (acres)	.61	--	1.614	--
Watermelon: Own (acres)	--	--	.48	--
Cantelope: Own (acres)	--	--	.88	--
Dairy: (animal unit)	--	.7	--	21.4
Cow-Calf: (animal unit)	1.8	2.4	3.2	
Feeder pig: (sow unit)	.83	--	--	--
Market hog: (hog unit)	1.25	--	--	--
Broiler: (thous. birds)	--	--	--	8.5

TABLE H-6. Optimal Enterprise Combination, by Limited Resource Farm Group, in Upper East Tennessee, 1976: Short-Run Allowing All Conventional Crop Enterprises; Hay and Corn Production Restricted as Intermediate Products Only (Program 5)

Enterprises and Net Income	Limited Resource Farm Group 1	2	3	4
Net Income: Short-run (dollars)	2,554	5,465	7,750	19,292
Tobacco:				
Own (pounds)	1,958	3,714	6,787	4,611
Rent-in (acres)	.144	.1	.97	--
Rent-out (acres)	.138	.017	.023	1.769
Sell (pounds)	150	--	--	--
Grain Corn:				
Own (acres)	.8	3.1	1.1	12.8
Rent-in (acres)	--	1	.3	3.7
Rent-out (acres)	--	.7	--	31.3
Buy (bushels)	16	--	--	--
Silage: Own (acres)	--	.4	--	4.4
Pasture: (acre)				
Rotation land	8.7	34	21.4	41.6
Permanent Pasture	3.7	14	9	14.3
Rent-in (rotation)	--	.2	--	6.1
Hay: Own (acres)	4	15.6	10	--
Dairy: (animal unit)	--	1.4	--	30.8
Cow-Calf: (animal unit)	6.3	21.4	12.1	--
Feeder Pig: (sow unit)	.8	.7	--	--
Market Hog: (hog unit)	1.3	--	--	--
Broiler: (thousand birds)	--	--	--	5

TABLE H-7. Optimal Enterprise Combination, by Limited Resource Farm, in Upper East Tennessee, 1976: Long-Run Allowing All Conventional Crop Enterprises; Hay and Corn Production Restricted as Intermediate Products Only (Program 5A)

Enterprises and Net Income	Limited Resource Farm Group			
	1	2	3	4
Net Income: Long-run (dollars)	2,176	4,400	6,955	18,321
Tobacco:				
Own (pounds)	1,957	3,715	6,843	5,401
Rent-in (acres)	0.144	.1	1.124	--
Rent-out (acres)	0.138	.017	.023	1.44
Sell (pounds)	150	--	--	--
Grain Corn:				
Own (acres)	0.3	1.0	--	10.0
Rent-in (acres)	--	.9	--	--
Rent-out (acres)	1.4	6.5	2.9	38.4
Buy (bushels)	17	2.8	--	148
Silage: Own (acres)	--	--	--	4.4
Pasture: (acres)				
Rotation land	10.6	45.0	29.4	37.0
Permanent Pasture	--	0.4	--	12.7
Rent-in (rotation)	--	0.2	--	12.0
Hay:				
Own (acres)	0.2	1.3	--	--
Buy (tons)	5.4	28	22	--
Dairy: (animal unit)	--	1.4	--	30.9
Cow-Calf: (animal unit)	6	26.1	17.7	--
Feeder Pig: (sow unit)	0.83	0.7	--	--
Market Hog: (hog unit)	1.25	--	--	--
Broiler: (thousand birds)	--	--	--	1.6

TABLE H-8. Optimal Enterprise Combination, by Limited Resource Farm, in Upper East Tennessee, 1976: Short-Run Allowing All Conventional Crop Enterprises and Selected Specialty Vegetable Crops; Hay and Corn Production Restricted as Intermediate Products Only (Program 6)

Enterprises and Net Income	Limited Resource Farm Group 1	2	3	4
Net Income: Short-run (dollars)	4,186	7,528	10,805	19,366
Tobacco:				
Own (pounds)	1,957	3,714	6,785	4,625
Rent-in (acres)	.144	.08	1.11	--
Rent-out (acres)	.138	.02	.024	1.764
Sell (pounds)	150	--	--	--
Grain Corn:				
Own (acres)	.1	1.9	.3	12.4
Rent-in (acres)	--	--	.02	3.7
Rent-out (acres)	.9	2.9	1.0	31.2
Buy (bushels)	37	32	--	--
Sell (bushels)	--	--	--	--
Silage: Own (acres)	--	.41	--	4.3
Pasture:(acres)				
Rotation land	6.8	29.3	17.2	42
Permanent pasture	3.6	15	9.0	14.2
Rent-in (rotation)	--	.2	--	6.1
Hay:				
Own (acres)	3.2	14.1	8.16	--
Rent-in (acres)	--	--	.3	--
Tomato:				
Own (acres)	.667	.725	1.217	.133
Rent-in (acres)	.08	.217	--	--
Snap Beans:				
Own (acres)	3.319	4.415	7.183	--
Rent-in (acres)	.472	.83	1.362	--
Dairy: (animal unit)	--	1.4	--	30.2
Cow-Calf (animal unit)	5.2	22.8	13.7	--
Feeder pig: (sow unit)	.83	.71	--	--
Market hog: (hog unit)	1.25	--	--	--
Broiler (thous. birds)	--	--	--	4.8

TABLE H-9. Optimal Enterprise Combination, by Limited Resource Farm Group, in Upper East Tennessee, 1976: Long-Run Allowing All Conventional Crop Enterprises and Selected Specialty Vegetable Crops; Hay and Corn Production Restricted as Intermediate Products Only (Program 6A)

Enterprises and Net Income	Limited Resource Farm Group			
	1	2	3	4
Net Income: Long-run (dollars)	4,600	7,781	12,058	18,555
Tobacco:				
Own (pounds)	1,957	3,757	6,785	4,908
Rent-in (acres)	.144	.08	1.156	--
Rent-out (acres)	.138	--	.024	1.555
Sell (pounds)	150	--	--	--
Grain Corn:				
Own (acres)	--	.88	--	8.9
Rent-in (acres)	--	--	--	1.2
Rent-out (acres)	1.3	6.0	2.2	39.0
Buy (bushels)	--	32.0		
Silage: Own (acres)	--	--	--	2.8
Pasture: (acres)				
Rotation land	8.4	40.6	18.4	34.7
Permanent pasture	--	.4	--	12.8
Rent-in (rotation)	--	.2	--	10.0
Hay: Buy (tons)	6.1	29.5	14.0	--
Tomatoes:				
Own (acres)	.691	.804	1.396	.131
Rent-in (acres)	.08	.217	--	--
Snap Beans:				
Own (acres)	3.615	4.963	7.702	3,348
Rent-in (acres)	.472	.83	1.392	--
Dairy: (animal unit)	--	1.2	--	28.0
Cow-Calf (animal unit)	5.0	24.0	11.4	
Feeder pig: (sow unit)	--	.71	--	--
Market hog: (hog unit)	1.25	--	--	--

TABLE H-10. Optimal Enterprise Combination, by Limited Resource Farm Group, in Upper East Tennessee, 1976: Long-Run Allowing All Conventional Crop Enterprises, Selected Vegetable Crops, and Feeder Pigs (Program 7)

Enterprises and Net Income	Limited Resource Farm Group 1	2	3	4
Net Income: Long-run (dollars)	$7,208	$13,347	$17,877	$22,846
Tobacco:				
Own (pounds)	1,520	2,183	3,430	3,205
Rent-in (acres)	.073	.08	.551	--
Rent-out (acres)	.32	.656	1.422	2.355
Sell (pounds)	150	--	--	--
Grain Corn:				
Own (acres)	5.6	22	21.3	40
Rent-in (acres)	--	4.3	12.8	6.9
Rent-out (acres)	4.5	22	6.04	33.7
Buy (bushels)	1,343	1,066	2,841	1,832
Sell (bushels)	--	135	--	250
Wheat:				
Own (acres)	--	--	--	.8
Rent-in (acres)	--	.6	.1	--
Pasture: (acres)				
Rotation land	5.8	9.4	9.3	15.7
Permanent pasture	4.8	14.5	15.1	14.4
Rent-in (rotation)	1.9	1.6	11.1	11.0
Rent-in (permanent pasture)	.4	--	--	--
Tomatoes:				
Own (acres)	.261	.06	--	.007
Rent-in (acres)	--	.19	.186	--
Snap Beans:				
Own (acres)	1.34	.157	--	--
Rent-in (acres)	--	--	1.337	--
Potato: Own (acres)	.77	--	--	--
Feeder pig: (sow unit)	41	76	112	133

VITA

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