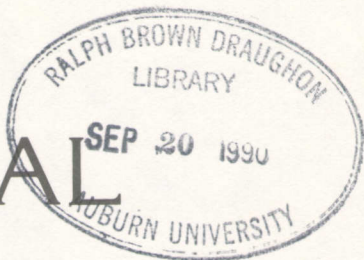AGRICULTURAL EXPERIMENT STATION
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AUBURN UNIVERSITY
AUBURN, ALABAMA

BULLETIN 518
MAY 1980

MANAGERIAL ABILITY AND ITS EFFECT ON

FARM GROWTH

CONTENTS

MANAGERIAL ABILITY

and its effect on

FARM GROWTH[1]

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INTRODUCTION

CHANGES IN AMERICAN AGRICULTURE over the past few years have resulted in more efficient production of food and fiber. Research and extension efforts by the land-grant college system and by agribusiness firms have provided a steady stream of technological improvements which enabled American farmers to become world leaders in agricultural production. These high levels of productivity were made possible through the use of such things as improved seed, herbicides, insecticides, and more efficient farm machinery. Significant increases in the farmer's costs of production and use of credit have come with this additional output.

Technological advancements, increased credit utilization, and competition for labor from other industries amplified the need for farmers to improve their managerial capabilities. Many farmers who lack adequate managerial capabilities are gradually being forced out of farming by their inability to cope with increasing costs and decreasing profit margins. Over the 10-year period from 1968 to 1977, the number of farms in the United States declined by an average of 1.1 percent annually, with a sub-

sequent decline in the farm population of 2.7 percent annually. While the U.S. population continued to increase during this period, farm population has decreased to the point where only 3.8 percent of the total U.S. population is now engaged in farming. These trends have resulted in an increase in average U.S. farm size from 363 to 393 acres (11).

The shift to larger farm units and increased mechanization has offset decreases in available labor and increased the need for greater emphasis on good farm management practices. Tolley projected that the entry of young farmers with more managerial capabilities into farming will result in an increase in efficiency and income level of farmers (10). Per capita farm income relative to nonfarm income was 53.9 percent in 1960, 74 percent in 1970, and by 1975 this ratio had grown to 88 percent (11), as young farmers with more abilities in farm business management entered farming. Emphasis on management in agriculture is expected to increase as farmers seek to increase farm income and profits through improved decision making.

The current agricultural situation indicates a shift toward more intensively managed farms. The impact of this continued pattern on the lower level manager's existence is unknown. By studying the firm growth behavior of various management levels, some indication of the future financial position of these farmers can be determined. Such work has been completed by other researchers (1, 3, 4, 5, 7, 8); however, none relates directly to Alabama. The research results presented in this report relate to farming situations typically found in north Alabama.

RESEARCH OBJECTIVES

The primary objective of this study was to determine the impact of managerial ability on the growth of the farm firm. Within the framework of this objective, specific objectives were as follows:

(1) Define and determine the characteristics of four managerial levels exhibited by farmers in Alabama.

(2) Select the optimum combination of enterprises for each management level over a 5-year period for an existing operation and a prospective farmer.

(3) Compare the growth potential for managers with varying managerial abilities for an existing operation and prospective or beginning farm situation.

CHARACTERIZATION OF INITIAL FARM
SITUATIONS AND MANAGEMENT LEVELS

A hypothetical farm operation based on enterprises common to north Alabama farms was assumed. Enterprises considered were: cotton, corn, soybeans, soybeans and wheat in a double-cropping system, silage, stockers produced on silage, stockers produced on winter grazing, complete confinement farrow to finish hog operation, and drylot market hog production. Guidelines for recommended management practices as established by the Agricultural Experiment Station and Cooperative Extension Service of Auburn University served as the basis for input level use.

Beginning Farmer Characteristics

Problems associated with the entry of new farmers into agriculture have received attention in recent years (2, 6). Increasing credit requirements necessary to provide investment capital have prevented many prospective farmers from entering the industry. In fact, many prospective farmers realize that without inheriting a family farm operation, entering a farm operation through marriage, or receiving financial support from family or individuals, it is almost impossible to get started.

Certain assumptions were made relating to all managerial levels for the beginning farmer. It was assumed that $50,000 in investment capital would be available to the beginning farmer and would be the maximum available for investment in machinery and equipment, buildings, and livestock operations. Borrowing for land was assumed to be unlimited. In addition, it was assumed that all beginning farmers could secure an operating capital line of credit in the amount of $50,000 from a bank or other lending institution. An amount of $5,000 was assumed available for investment in the farm from personal funds. This level of personal investment was assumed appropriate, especially for young prospective farmers. Investments in all assets including land after the first year were possible based on borrowing at 75 percent of the equity value in assets. Equity created by loan payments was included in this borrowing capacity.

Beginning farmers were assumed to be able to rent land for all enterprises. This allowed for row crop operation prior to the purchase of land. A further assumption for beginning farmers al-

lowed for custom harvesting of a maximum of 200 acres of grain
and soybeans and 100 acres of cotton.

Established Farmer Characteristics

In contrast to the beginning farmer situation, established farm-
ers face problems concerning continued growth of the farm firm
or, for many farmers, continued operation of the firm. Certain
assumptions were made relating to all managerial levels for es-
tablished farmers. Differences in assumptions made for be-
ginning and established situations are presented in table 1. Invest-
ment and operating capital were assumed to have an upper limit
of $500,000 each for established situation farmers. A borrowing
capacity limitation of 75 percent of the equity value of the farm
assets was included for the established situation. Equity created
by loan payment was added to the borrowing capacity. Land was
also subjected to the 75 percent borrowing capacity constraint.
Established farmers were assumed to own 200 acres of land and
have $10,000 cash for investment from personal funds. It was
further assumed that the land was inherited or had been owned
for a sufficient time to have no outstanding debt involved. The
established manager was assumed to own farm machinery suffi-
cient to provide 1,000 tractor hours, 300 combine hours, and 100
cotton picker hours. Also, it was assumed that $50,000 was owed
on this machinery, with three annual payments remaining.

TABLE 1. DIFFERENCES IN ASSUMPTIONS FOR BEGINNING AND
ESTABLISHED FARM SITUATIONS

Farm characteristic	Beginning	Established
Personal investment............	$ 5,000	$10,000
Operating capital borrowing limit	$50,000	$500,000
Investment capital borrowing limit	$50,000	$500,000
Land owned initially	none	200 acres
Machinery owned initially	none	tractors providing 1,000 hours annually, combine providing 300 hours annually, and cotton picker providing 100 hours annually
Custom harvesting (maximum allowed)	200 acres grain and 100 acres cotton in 1978 and 1979	none
Initial debt....................	0	$50,000 investment capital; land was assumed debt free.

Management Level Characteristics

Efforts to distinguish the various characteristics of manage-
ment levels present significant difficulties in quantifying the in-
tangible aspects of management. The existence of managers with
varying abilities has been recognized for some time as farmers
have exhibited the expected results associated with various man-
agement levels. Several factors are typically associated with the
attainment of higher level managerial capabilities, such as in-
creased yields of crops and livestock, more efficient input utili-
zation, recognition of the need for assistance in areas of weak-
ness, concentration on farm records and business organization,
and increased efforts to improve marketing ability. All of these
traits are possessed by top level managers, whereas lower levels
of capability are delineated according to the lack of concentra-
tion or existence of one or more of these characteristics.

Four management levels of Alabama farmers were established
based on variations in productivity and input utilization: supe-
rior, improved, average, and below average. Beginning and
established farm situations for all management levels were
assumed to consider the same enterprises and investment alterna-
tives, with the principal difference being variations in producti-
vity and thus lower costs per unit produced for higher manage-
ment levels. Hypothesized yield variations were based on such
factors as timeliness of planting, timeliness and optimal use of
herbicides and insecticides, timeliness of cultivation and other

TABLE 2. ENTERPRISE YIELD PROJECTIONS FOR FOUR SPECIFIED
MANAGEMENT LEVELS

Enterprise	Below average	Average	Improved	Superior
Cotton, lb./acre	360	480	600	720
Soybeans[1], bu./acre	18	24	30	36
Soybeans[2], bu./acre	15	20	25	30
Wheat, bu./acre	24	32	40	48
Corn, bu./acre	42	56	70	84
Silage, tons/acre	8.4	11.2	14	16.8
Stockers[3], lb./unit	56,000	63,000	70,000	77,000
Stockers[4], lb./unit	11,200	12,600	14,000	15,400
Hogs[5], lb./unit	293,408	330,084	366,760	403,436
Hogs[6], lb./unit	258,720	291,060	323,400	355,740

[1]Single-cropped soybeans.
[2]Double-cropped soybeans.
[3]Stockers produced on silage.
[4]Stockers produced on winter grazing.
[5]Farrow to finish hog unit of 100 sows.
[6]Market hog unit of 1,500 head.

field activities, knowledgeable use of all inputs, improved record-keeping and analysis, and efficiency in managing labor and directing the operation. Costs of production were assumed to be the same for all levels except the superior managerial level. For this level, costs exceeded the other levels by 10 percent. The superior manager was assumed to be involved more in intensive management activities and less in labor activities.

Crop yields were varied in 20-percent increments and livestock yields in 10-percent increments from the improved managerial level, which was selected as the base level. This level represents approximately 20 percent higher yields for crops than the State average and is based on recommended practices and optimal input use. Livestock yields were varied in 10-percent increments due to less expected variability on Alabama farms. Crop and livestock yields for all managerial levels are presented in table 2. It was assumed for all levels in both beginning and established situations that the drylot market hog enterprise (buying feeder pigs) would have an upper limit of four units or 6,000 head per year. This level represents a unit requiring approximately one full-time man's labor.

Further assumptions affecting all managerial levels for the beginning and established farm situations were an 8.8-percent annual increase in costs, both variable and fixed. This rate reflects the average annual change in the Index of Prices Paid for production items, interest, taxes, and wage rates from 1965 to 1976. Crop and livestock prices were increased by 7.3 percent annually, reflecting the average annual percentage increase in the Index of Prices Received for all farm products over the same period. Land appreciation was projected at an annual rate of 11.2 percent, based on the average annual increase in land prices in Alabama from 1968 to 1977.

Superior Managerial Level

The farmer possessing superior managerial abilities best exemplifies the desired traits of the successful modern farm businessman. Through intensive management of the farm, the superior manager was assumed to achieve crop yields 20 percent above the improved managerial level and livestock yields 10 percent greater than the improved managerial level. Variations of 20 percent for crops and 10 percent for livestock reflect the productivity available with present technology, optimal input use, and intensive management. The superior manager's absence from di-

rect personal labor involvement would cause an increase in costs since additional labor with some managerial abilities would be required to supervise the daily enterprise activities. However, his increased productivity would result in lower costs per unit of product from each enterprise.

The superior manager was assumed to have been trained in farm business management and to have a continuing education approach toward improving his business. His abilities would enable him to manage an unlimited labor supply, and size of enterprise was not constrained by any limits on the activity levels. The beginning superior manager was constrained in the growth model only by the imposed constraint of $50,000 operating capital, $50,000 investment capital, and his personal salary of $15,000 per year. A further constraint of $5,000 personal cash to invest in the first year by the beginning manager restricted the early growth of the farm firm.

The established superior manager was restricted by his personal salary allowance of $15,000 annually and the personal investment limit of $10,000 in the first year.

Improved Managerial Level

Characteristics of the improved managerial level were based on the recommended management practices for this level in budgets established by the Agricultural Experiment Station and Cooperative Extension Service of Auburn University. Improved management implies optimum input utilization with intensive management of enterprises. The improved management level farmer was assumed to have some direct involvement in the labor activities of the various enterprises. Total costs per unit of enterprise were the same as those of average and below average levels.

The improved managerial level farmer was assumed to have training in farm management and to have improved his managerial capabilities through continued development. With these managerial abilities, the improved managerial level farmer was assumed to have the ability to manage a labor force of three full-time men plus seasonal labor available in the period of wheat harvest and soybean planting for the double-cropping system. Labor availability for all levels is presented in appendix table 1 for six labor periods. This labor availability and the personal salary of $12,000 per year represent the constraints common to only the

improved managerial level for the beginning farm situation. In addition to these constraints, the established farmer operating at this management level was also subjected to the constraints common to all farmers in the established farm situation.

Average Managerial Level

The average managerial level was characterized by crop yields 20 percent less and livestock yields 10 percent less than the improved managerial level. Failure by farmers in this management level to provide timely planting dates, herbicide applications, and field operations was recognized as a major shortcoming in management. These yields represent close approximations of the Alabama average yields for these enterprises.

The general assumptions and constraints for all levels of beginning farm situations were assumed for the average level, with additional constraints on labor and personal salary. Lack of managerial ability was assumed to limit his management of labor to two full-time hired men in addition to himself. The personal salary constraint for this level was $9,000 per year based on the expected earning potential of this managerial level in alternative occupations. A further constraint was imposed on the complete confinement farrow to finish hog enterprise, limiting to a maximum of 50 sows. In addition to these constraints, the established farmer with average managerial abilities was subjected to the constraints common to all farmers in the established farm situation.

Below Average Managerial Level

The yield characteristics assumed for the below average managerial level represent the extreme situation resulting from inefficient input utilization and failure to provide timely use of inputs or operations involved in production of the enterprise. Crop yields were assumed 40 percent less than the improved managerial level, which served as the base level for the entire study. Livestock yields were assumed 20 percent less than the improved managerial level.

Farmers in this management level were assumed to have no formal farm management training. Their efforts were assumed to be directed entirely toward the daily operation of the farm, with direct involvement in the labor activities associated with the

various enterprises. The lack of managerial ability was assumed to result in the extremely low yields associated with this level.

The general assumptions and constraints for all levels of beginning farm situations were assumed for the below average level, with additional constraints on labor and personal salary. The below average manager was assumed to have managerial abilities sufficient only to manage one full-time hired man in addition to himself. The personal salary constraint imposed on this management level was $6,000 per year. A further constraint limited the below average manager to a maximum of 50 sows in the complete confinement farrow to finish hog enterprise. This enterprise would be constrained also at this management level by the reduced labor availability. Additional constraints were assumed for the established farm situation at this management level common to those of all other levels for established farm situations.

DEVELOPMENT OF ENTERPRISE BUDGETS

Enterprise budgets were developed for the productive enterprises and supporting enterprise activities to project the estimated costs and returns associated with each enterprise. As previously stated, total variable costs per unit of enterprise were inflated in successive years by 8.8 percent, while receipts were inflated by 7.3 percent. Costs per productive unit were assumed equal for all management levels except the superior level whose costs were assumed 10 percent greater than the other levels. These costs are presented for the various enterprises in appendix table 2. Returns or prices per unit of product were assumed equal for all management levels.

Budgets developed for north Alabama farms by Auburn University — based on the use of recommended management practices — provided guidelines for the development of the improved managerial level budgets. These budgets also served as the basis for development of budgets for other managerial levels. The budgets developed for the improved managerial level are presented in appendix tables 3-15. Other levels are not presented due to the volume of material involved.

MODEL SPECIFICATION

A multiperiod linear programming model was developed to stimulate the growth of a farm firm over a 5-year period. It was

adapted for use with the four management levels assumed in the study for both the beginning and established farmer situations. The model satisfied the assumptions of linear programming and also the assumptions made with respect to management levels. It was also developed consistent with the microeconomic theory of the firm.

The model included activities or enterprises common to north Alabama farms. Within the matrix, all enterprises were divided into production activities and selling activities. The production for a given enterprise was transferred to the selling activity through a transfer row. This allowed, for example, corn to be produced and sold or fed to stockers in the stocker-silage enterprise or fed to hogs in the farrow to finish or market hog enterprise. Also, corn could be purchased to meet all or part of the feed requirements.

Acquisition of operating capital was based on the quarterly operating capital requirements of the various activities. In year one, the manager's personal cash investment could be transferred within the model to operating capital or investment capital for the various investment alternatives. Cash generated by selling activities was available to meet operating capital requirements in the respective period or to pay back operating capital borrowed in the preceding period, or it was transferred to future periods for use as operating capital. Operating capital borrowed in periods with deficit operating capital balances was specified within the model to be repaid within the following three quarters. Interest was charged on the unpaid balance at an annual rate of 9 percent. Inclusion of these activities provided the model with a built-in cash flow system. Expenditures for the production activities resulted in removal of cash from the system, while receipts from the selling activities resulted in cash acquisitions when activated by an optimal solution. Deficit cash needs in any period resulted in the borrowing of cash for operating capital. Repayment of the loan plus interest occurred upon receipt of sufficient cash flow into the system through selling activities. An optimal solution based on this multiperiod matrix indicated the optimum combination of enterprises and the operating capital requirements for these enterprises. The limit imposed on borrowing capacity for operating capital served as a constraint on the selection of the optimum enterprise combinations.

Investment capital for machinery, buildings, breeding stock for the farrow to finish hog enterprise, and land could be ac-

quired from earnings, borrowing within specified constraints, or from personal cash for investment. Acquisition of farm machinery, buildings, and land within any year of the plan resulted in availability of these resources in subsequent years of the multiperiod model.

Investment capital borrowed for farm machinery was required to be paid back in 4 years. The machinery was assumed to have a useful life of 7 years. Investment capital borrowed for building for the complete confinement farrow to finish hog enterprise had a repayment period of 10 years. Borrowing for breeding stock for the hog enterprise had a repayment period of 2 years. Land purchases made possible by borrowing of investment capital were amortized over a 30-year mortgage term. The interest rate charged on operating capital and all investment alternatives except land was 9 percent annually on the unpaid balance. The interest rate on land purchases was 8.25 percent annually.

The initial purchase of breeding stock for the hog enterprise resulted in continuous availability of breeding stock through replacement gilts raised within the enterprise. This hog enterprise provided for a 2-year cycle of sows with 50 percent of the sows replaced each year. The initial purchase of boars provided for initial boar requirements, with annual replacement of boars charged to the enterprise as a variable cost.

RESULTS

The growth study covered the 5-year period from 1978 to 1982. The multiperiod linear programming matrix was modified to obtain solutions for both the beginning and established farm situations at all management levels. The objective for each analysis was to maximize net income over the period.

Beginning Farm Situations

Below Average Managerial Level

The below average manager was unable to establish a farm operation, even under the assumption of perfect certainty regarding prices and yields made in development of this model. It was determined that over $100,000 would be required to begin operation, in addition to the capital provided in the model.

Poor crop yields and low livestock productivity associated with this level made it impossible for this manager to meet the constraint of $6,000 annually for family living expenses.

Average Managerial Level

A similar situation resulted for the beginning farmer with average managerial ability. The inability of this level to satisfy the $9,000 family living expense constraint, while satisfying the other constraints of the model, resulted in termination of the search for an optimal mix of crop and livestock enterprises.

Improved Managerial Level

The beginning farmer with improved managerial capabilities was able to establish a profitable farm operation, the first management level to achieve this success. Annual and total net income for this level are presented in table 3. Net income values presented represent net income above family living expenses and all costs, including interest and loan repayments. The improved manager achieved a consistent positive growth pattern; however, net income in the fifth year was less than in the fourth year. This reduction resulted from the consistent increase in production costs at a greater rate than receipts. Also, the labor constraint prevented the improved manager from offsetting cost increases with

TABLE 3. COMPARISON OF ANNUAL AND TOTAL NET INCOME[1] BY MANAGEMENT LEVEL FOR BEGINNING FARM SITUATIONS, 1978-82

Management level	Net income, by year					
	1978	1979	1980	1981	1982	Total
Below average[2]	TERMINATED					
Average.........	TERMINATED					
Improved	$28,444	$ 67,107	$ 86,184	$105,217	$100,853	$ 387,805
Superior	54,694	149,587	249,789	302,145	347,840	1,104,056

[1]Net income is the net income above family living expenses and all costs, including interest and loan repayments.
[2]Level was unable to begin operation.

TABLE 4. COMPARISON OF NET WORTH BY MANAGEMENT LEVEL FOR BEGINNING FARM SITUATIONS, 1978-82

Management level	Net worth, by year				
	1978	1979	1980	1981	1982
Below average[1]	TERMINATED				
Average[1]	TERMINATED				
Improved	$ 3,854	$ 71,429	$ 98,597	$155,891	$157,648
Superior	30,515	149,939	409,928	616,549	881,890

[1]Level was unable to begin operation.

increased production. Total net income for the 5-year period was $387,805 for the improved managerial level. Net worth increased significantly after the first year, reaching $157,648 in the final year of the period, table 4. After land was purchased, net worth increased with the aid of appreciation in land values.

Farm growth for this level occurred with the enterprises in solution at the specified levels in table 5. The $5,000 personal cash was used to meet operating capital requirements in the first year. Activity levels for hired labor (number of full-time men) and market hogs (number of 1,500-head units produced) represent upper limits during 1980-1982 on labor and 1978-1981 on market hogs. The market hog activity provided the necessary cash flow in 1978 to satisfy all the constraints of the model and provided internally generated capital for both operating and investment capital needs in the following year. Over the planning horizon, stockers were gradually phased out and the single-cropped soybean acreage was reduced as the soybean and wheat double-cropped acreage increased. Cotton entered the optimal solution in years 1981 and 1982.

The results indicated a trend toward utilization of livestock activities with low investment capital requirements to generate internal funds for investment. These funds were used first to increase crop production on the crops requiring the least invest-

TABLE 5. OPTIMAL ENTERPRISE SELECTION FOR THE IMPROVED MANAGERIAL
LEVEL IN THE BEGINNING FARM SITUATION, 1978-82

Enterprise	1978	1979	1980	1981	1982
Cotton, acres.....................				269	468
Soybeans[1], acres.................		434	707	417	265
Soybeans[2], acres.................		140	147	291	272
Wheat, acres		140	147	291	272
Market hogs, units	4	4	4	4	3.9
Buy corn, bushels................	56,424	56,424	56,424	56,424	54,973
Stockers[3], units		3.8	7.2	.5	
Winter grazing[4], acres............		61	116	9	
Hired labor[5]	1	2	3	3	3
Seasonal labor, hours		138	78	608	664
Rent land, acres		539	780	654	186
Buy land, acres..................		35	38	250	495
Buy tractor[6].....................		1	1	1	1
Buy combine.....................		1			
Buy cotton picker				1	1

[1]Single-cropped.
[2]Double-cropped with wheat.
[3]Stockers on winter grazing (20 steers per unit).
[4]Winter grazing for stockers (0.8 acre per head).
[5]Full-time hired men.
[6]Tractor supplying 750 hours use annually.

ment capital, soybeans and soybeans and wheat double-cropped. Cotton production was then possible when the cash flow from the row crops and the declining livestock activity levels provided sufficient capital for investment and available labor for production. The transfer of internally generated cash to investment indicated this progression. Transfers were made at the ends of the respective years to the beginning of the following year as follows: 1978—$28,444; 1979—$31,961; 1980—$86,184; and 1981— $105,217.

Land purchases were made in 1979 and 1980 of 35 and 38 acres, respectively. Larger land purchases, 250 and 495 acres, were made after cotton was integrated into the operation. Additional land was rented on a cash rent basis at $35 per acre for the various row crop activities. The level of rented acreage peaked in 1980 at 780 acres prior to the introduction of cotton into the operation. The results indicated therefore that the profitability of cotton was high and made possible larger land purchases than were possible prior to its utilization in the operation. However, the high operating capital and investment capital requirements prevented its entry into the solution at an earlier date.

In addition to land purchases, the improved manager purchased the following machinery with borrowed and internally generated investment capital: one tractor in each year except 1978 for a total of four, one combine in 1979, and cotton pickers in both 1981 and 1982. The number of tractors exceeded the number of full-time workers; however, seasonal labor was utilized at the period of heaviest machinery requirement and used when wheat was harvested and soybeans planted.

Hired labor provided a major constraint to the improved manager in the latter years of the model. Hired labor was bounded at an upper limit of three full-time men in addition to the operator, with seasonal labor also available in the period of wheat harvest and soybean planting for the double-cropping activity. Relaxation of this labor constraint would result in an increase in the activity levels in the last 2 years.

Superior Managerial Level

The beginning situation for the superior managerial level provided insight into the situation occurring when the manager is not directly involved in the daily labor activities of the various enterprises. Annual and total net income for the superior managerial

TABLE 6. OPTIMAL SOLUTION FOR THE SUPERIOR MANAGERIAL
LEVEL IN THE BEGINNING FARM SITUATION, 1978-82

Enterprise	1978	1979	1980	1981	1982
Cotton, acres.....................	100			545	1,091
Soybeans[1], acres..................		1,100	1,313	112	97
Soybeans[2], acres..................	24		678	1,342	812
Wheat, acres	24		678	1,342	812
Corn[3], acres.....................	85				
Market hogs, units	4	4	4	4	4
Buy corn, bushels.................	49,322	62,619	56,424	56,424	79,424
Farrow-finish hogs, units					1
Stockers[4], units	3.7				
Winter grazing[5], acres.............	59				
Stockers[6], units			9.6		
Silage[7], acres		141			
Hired labor[8], men	1	6	6	9	9
Seasonal labor, hours	25		1,258	1,709	1,440
Rent land, acres	209	1,057	1,313	634	
Buy land, acres..................		183	497	687	634
Buy tractor[9].....................	1	1	2	3	2
Buy combine.....................		1	2		
Buy cotton picker				2	2
Custom combine, hours	40	30			
Custom cotton picker, hours	110				

[1]Single-cropped.
[2]Double-cropped with wheat.
[3]Produced for the market hog activity.
[4]Stockers on winter grazing (20 steers per unit).
[5]Winter grazing for stockers (0.8 acre per steer).
[6]Stockers on silage (100 steers per unit).
[7]Corn silage for the associated stocker activity.
[8]Full-time hired men.
[9]Tractor supplying 750 hours use annually.

level are presented in table 3. Net income was defined as the income above family living expenses and all farm business expenses, including interest and loan repayments. Positive net income values were attained in all years with cumulative net income also increasing consistently over the 5-year period. The superior manager increased production to overcome the cost-price squeeze simulated by the 1.5 percent increase in production costs over enterprise product receipt prices each year. Total net income for the 5-year period was $1,104,056 for the superior managerial level. Net worth increased from $30,515 in 1978 to $881,890 in 1982. Larger increases occurred after land was purchased and its value had appreciated. Borrowed capital was utilized extensively to supplement internally generated capital, as had been the case with the improved management level.

The optimal solution for the superior managerial level is presented in table 6. The superior manager required $1,750 of capital to begin operation in the optimal solution, in addition to the

$5,000 personal cash. This cash could be acquired in a real situation by reducing the family living expenses by this amount in the first year or by borrowing funds in excess of those specified in the model. This option was not permitted with other managerial levels since amounts required would not reasonably be available.

In 1978, the superior manager was directly involved and only one full-time hired man was utilized. After the first year, however, additional men were hired until a maximum of nine men were hired in years 1981 and 1982. The optimal enterprise selection progressed toward a labor and capital intensive operation. Extensive capital requirements resulted in the maximum utilization of the drylot market hog enterprise in all years. Corn requirements were met entirely from bought corn for this enterprise in all years except 1978 when 85 acres of corn were produced.

Also, stockers on grazing were produced only in 1978. These results also indicated the trend toward shifting to more capital intensive enterprises as soon as the cash for operating and investment capital could be generated internally. Limited capital available from borrowing was the reason for this trend.

The superior manager produced 100 acres of cotton in 1978, the maximum level possible when utilizing custom cotton harvesting. Cotton was not in the optimal solution again until 1981 when capital was available for the purchase of cotton pickers. Row crops dominated the solution in 1979, with production of 1,100 acres of single-cropped soybeans and 141 acres of corn silage for the stockers on silage enterprise. After 1979, the only livestock enterprise in solution was the market hog activity until 1982 when the shift toward capital intensive activities was fully realized. The farrow to finish hog enterprise was activated at one unit in 1982 and was part of a solution which included 1,091 acres of cotton and 812 acres of soybeans and wheat double-cropped.

Land purchases for this managerial level began in 1979 and were made in each of the remaining years until the 2,000-acre maximum was attained. Additional land was rented each year on a cash rent basis to satisfy the land requirements until 1982, when all land requirements were met by the accumulated land purchased over the 5-year period. Years 1981 and 1982 had the highest acreage purchased and, as was the case with the improved level, cotton was part of the optimal solution in those years. Relaxation of the maximum land constraint would result in continued land purchases by the superior manager.

The superior manager had significant investment in machinery over the 5-year period. In 1979, only one tractor was purchased and all crops were custom harvested. However, eight tractors, three combines, and four cotton pickers were purchased in the remaining 4 years. In addition to these capital investments, the farrow to finish hog enterprise required the purchase of one unit of breeding stock (100 sows and 4 boars) and buildings for this enterprise, at a cost of $95,285 in 1982.

The superior manager would be expected to continue this growth pattern as his constantly increasing net worth would provide borrowing capacity to supplement the internally generated funds for investment. Growth would ultimately be based on the individual preferences of this manager with respect to other goals he might have for himself and his family.

Established Situations

Below Average Managerial Level

The below average managerial level was unable to survive in the established situation due to the low productivity associated with this level. Even with land and machinery available initially, the capital requirements exceeded the $10,000 initial capital availability.

Average Managerial Level

The average manager in the established situation was able to continue the farm operation and experience growth. This was in contrast to the beginning situation where the average level farmer was unable to establish an operation. The assets held by established farmers and the $10,000 personal cash for investment in the

TABLE 7. COMPARISON OF ANNUAL AND TOTAL NET INCOME[1] BY MANAGEMENT LEVEL FOR ESTABLISHED FARM SITUATIONS, 1978-82

Management level	Net income, by year					
	1978	1979	1980	1981	1982	Total
Below average[2]	TERMINATED					
Average........	$ 19,212	$ 21,503	$ 23,335	$ 38,981	$ 34,722	$ 137,754
Improved	69,669	66,864	70,215	80,559	74,404	361,711
Superior	126,047	241,991	234,309	269,948	331,328	1,203,622

[1]Net income is the net income above family living expenses and all costs, including interest and loan repayments.
[2]Level was unable to continue operation profitably.

firm made possible the survival of this level. Therefore, the continued existence of farmers at this level would be expected if conditions continue as projected in the model.

The growth pattern, as measured by net income, is presented in table 7. Net income was defined for managerial levels in the established situation as income above family living expenses and all costs, including interest and loan repayment. Over the 5-year period, the average manager had total net returns of $137,754 and his net worth increased from $160,253 to $441,133, table 8. In contrast to the beginning situation, established farmers had a base operation to provide a higher initial net worth. This provided a stronger net worth growth pattern.

TABLE 8. COMPARISON OF NET WORTH BY MANAGEMENT LEVEL FOR
ESTABLISHED FARM SITUATIONS, 1978-82

Management level	Net worth, by year				
	1978	1979	1980	1981	1982
Below average[1]	TERMINATED				
Average.............	$160,253	$202,303	$222,477	$308,858	$441,133
Improved	168,419	211,665	262,867	316,001	644,183
Superior	168,418	325,399	679,069	1,134,641	1,778,053

[1]Level was unable to begin operation.

The optimal solution for the average managerial level, table 9, presents a stable situation after the first year when the average manager utilized his personal funds for operating capital and produced only row crops. In the remaining 4 years, cotton, soybeans, and soybeans and wheat double-cropped maintained almost constant levels of production. Stockers on grazing were in the solution in only the second and third years of the planning horizon and were at six units in both years. Land was purchased at an increasing rate beginning in 1979. In the period 1979-1982, 481 acres were purchased to supplement the 200 acres assumed to be owned in the initial year of the plan. Over this same period, the acres of land rented declined steadily due to the land purchases and the stable levels of activities in solution. This pattern of continued land purchases and reduction in rented land would be expected to continue until the farm owned all the land necessary for production if projected economic conditions persisted in future years.

The labor constraint presented the most severe restriction on the growth of the average managerial level firm. The maximum labor of two full-time men was hired in all years except the first.

TABLE 9. OPTIMAL SOLUTION FOR THE AVERAGE MANAGERIAL LEVEL
IN THE ESTABLISHED FARM SITUATION, 1978-82

Enterprise	1978	1979	1980	1981	1982
Cotton, acres.....................	72	91	91	91	91
Soybeans[1], acres..................	122	721	721	724	724
Soybeans[2], acres..................	306	139	139	138	138
Wheat, acres	306	139	139	138	138
Stockers[3], units		6	6		
Winter grazing[4], acres.............		97	97		
Hired labor[5], men	1	2	2	2	2
Seasonal labor, hours	398	178	178	160	160
Rent land, acres	300	695	594	472	273
Buy land[6], acres		57	101	124	199
Buy tractor[7].....................		1			

[1]Single-cropped.
[2]Double-cropped with wheat.
[3]Stockers on winter grazing (20 steers per unit).
[4]Winter grazing for stockers (0.8 acre per steer).
[5]Full-time hired men.
[6]200 acres were initially owned by established farmers.
[7]Tractor supplying 750 hours use annually.

Relaxation of this constraint would probably have an impact on the optimal selection of enterprises for this managerial level. However, this level was originally assumed to lack sufficient managerial ability to manage labor at a higher level than two full-time men.

Improved Managerial Level

The improved managerial level for the established farm situation followed a trend similar to that of the average managerial level. Annual and total net income for the improved level are presented in table 7. The improved manager had a total income over the planning period of $361,711. Net worth increased to $644,183 in the fifth year, table 8.

Table 10 presents the optimal solution for the 5-year period that resulted in the growth in net income for the improved management level. The first year of the planning period was utilized as a year of building cash reserves for investment in future years. The improved manager divided his personal cash investment in the farm between operating and investment capital at $3,250 and $6,750, respectively. The optimal solution calls for the utilization of market hogs and stockers on grazing to generate a strong cash flow with low investment capital requirements in 1978. After the first year, livestock activities were not included in the optimal solution.

TABLE 10. OPTIMAL SOLUTION FOR THE IMPROVED MANAGERIAL
LEVEL IN THE ESTABLISHED FARM SITUATION, 1978-82

Enterprise	1978	1979	1980	1981	1982
Cotton, acres.....................	91	623	623	623	623
Soybeans[1], acres..................		467	467	467	467
Soybeans[2], acres..................	169	322	322	322	322
Wheat, acres	169	322	322	322	322
Corn, acres	457				
Market hogs[3], units	3.6				
Buy corn, bushels.................	19,284				
Stockers[4], units	7.4				
Winter grazing, acres	118				
Hired labor[5], men	3	3	3	3	3
Seasonal labor, hours	521	874	874	874	874
Rent land, acres	516	1,204	887	503	14
Buy land[6], acres		8	317	384	489
Buy tractor[7]......................	1	4			
Buy combine.....................		1			
Buy cotton picker		2			

[1]Single-cropped.
[2]Double-cropped with wheat.
[3]1,500 head per unit.
[4]Stockers on winter grazing (20 steers per unit).
[5]Full-time hired men.
[6]200 acres owned initially.
[7]Tractor supplying 750 hours use annually.

The remaining 4 years of the planning period were very stable, with cotton, single-cropped soybeans, and double-cropped soybeans and wheat in the optimal solution at a constant level. During this period, labor was utilized at the maximum allowable level, three full-time men. Relaxation of this constraint would change the optimal solution and growth pattern for this level. However, the original assumption placed this labor constraint on the improved level to permit study of the growth pattern of an efficient farm firm where the manager is still involved in the daily activities of the farm.

The trend of consistently increasing land purchases was evidenced for the improved level beginning in the second year of the plan. As land purchases increased, the level of utilization of rented land declined. At the end of the period, the improved manager owned a total of 1,398 acres, including 1,198 acres purchased and the 200 acres assumed owned initially.

Investment in machinery was completed by the improved manager in the second year of the plan. One tractor was purchased the first year, followed by four tractors, one combine, and two cotton pickers in the second year. Additional machinery was not necessary because the activity levels for the row crop enterprises were constant for the remainder of the planning period.

The stability of the improved managerial level indicated the potential for a more stable agricultural sector through the adoption of improved management practices by farmers. It further indicated the potential results available for "family farms." The constraints on this level could be satisfied when sound financial management and farm management are implemented on such operations.

Superior Managerial Level

The optimal solution for the superior managerial level, table 11, presented a diversified farming operation with a high level of capital and labor utilization. Total net income for the superior managerial level, presented in table 7, indicated rapid growth when measured in terms of net income. Over the 5-year period, total net income of $1,203,622 was realized. Net worth had also increased rapidly, to the final value of $1,778,053, table 8.

The superior manager utilized the first year of the period to create internally generated capital for investment in the capital intensive activities of the future periods. In the second through the fifth years, row crop activities stabilized at the maximum

TABLE 11. OPTIMAL SOLUTION FOR THE SUPERIOR MANAGERIAL LEVEL
IN THE ESTABLISHED FARM SITUATION, 1978-82

Enterprise	1978	1979	1980	1981	1982
Cotton, acres.....................	29	1,302	1,455	1,455	1,455
Soybeans[1], acres..................	335	395	91	91	91
Soybeans[2], acres..................	109	302	455	455	455
Wheat, acres	109	302	455	455	455
Corn, acres	447				
Farrow-finish hogs[3], units				2	2
Market hogs[4], units	4	4	4	4	4
Buy corn, bushels.................	18,913	56,424	56,424	102,424	102,424
Stockers[5], units	13.2	17.8	19.9	23.9	23.9
Winter grazing, acres	211	286	318	382	382
Hired labor[6], men	4	8	9	13	13
Seasonal labor, hours	246	266	262		
Rent land, acres	719	1,800	742	36	
Buy land[7], acres			1,058	706	36
Buy tractor[8].....................	1	8	1		
Buy combine.....................					
Buy cotton picker		5			

[1]Single-cropped.
[2]Double-cropped with wheat.
[3]100 sows per unit.
[4]1,500 head per unit.
[5]Stockers on winter grazing (20 steers per unit).
[6]Full-time hired men.
[7]200 acres owned initially.
[8]Tractor supplying 750 hours use annually.

acreage allowable in the model. Within this 2,000-acre maximum, the superior manager established a stable row crop system with cotton as the leading crop. After cotton reached its maximum level, land purchases were initiated to supplement the 200 acres owned and supply the entire 2,000 acres in the fifth year from land owned by the farm. After the major land purchase in 1980 of 1,058 acres, capital became available within the operation to initiate a 200-sow farrow to finish hog operation. It continued in the solution at this level in the fifth year.

The absence of a constraint on labor allowed for continuation and expansion of the livestock activities in the optimal solution. This is contrary to the trend established by previous levels, but was expected when labor was not constrained within the model. The superior manager utilized a maximum labor force of 13 men in 1981 and 1982 with no seasonal labor hired. Relaxation of the constraint on maximum acreage available would result in additional requirements for hired labor.

Capital investments in machinery were completed in 1980, the third year of the plan, with purchases over this period of 10 tractors and 5 cotton pickers. Investment capital in the last 2 years was utilized by the farrow to finish hog operation which required $209,672. These requirements were supplied entirely by internally generated funds of investment capital.

SUMMARY

The primary objective of this study was to determine the impact of managerial ability on farm firm growth. Within this objective, four managerial levels — below average, average, improved, and superior—were characterized. Multiperiod linear programming models were developed to simulate beginning and established farm situations for each management level. Optimal solutions were obtained for each of these management levels, and comparisons were made with respect to the enterprise combinations and growth potential for each respective level in both beginning and established situations. Enterprise budgets were developed for cotton, corn, single-cropped soybeans, double-cropped soybeans and wheat, market hogs, farrow to finish hogs, and stockers on winter grazing and silage, winter grazing, and silage, enterprises common to north Alabama farms.

Enterprise budgets were based on improved management practices recommended by Auburn University for north Ala-

bama. Varying managerial capabilities were accounted for by assumed variations in yields. The improved managerial level served as the base level. Yields for average and below average management in comparison with improved management were, respectively, 20 percent and 40 percent less for crops and 20 and 10 percent less for livestock. Variations in yield provided different levels of productivity and lower costs per unit of product for the higher managerial levels.

The superior managerial level was assumed to exceed improved level crop yields by 20 percent and livestock yields by 10 percent. However, the superior manager was assumed to experience 10 percent greater costs than the other three levels due to less direct involvement in daily work activities with the various enterprises and therefore greater labor costs. His increased productivity enabled him to offset this situation.

Optimal solutions for the beginning farmer situation were as expected. The below average and average levels were unable to succeed in establishing a farm business. Low productivity accompanied by limited credit availability prevented these levels from generating the necessary cash flow to meet the ever increasing capital needs as the 5-year period progressed. The improved and superior levels obtained successful operations through increased efficiency and productivity. Net income increased in all years for the superior level; however, the improved level had a decline in the fifth year. This decline resulted because increased productivity and efficiency of the improved level returned less than was lost from higher cost increases in relation to product prices. The superior level, however, through the implementation of a farrow to finish hog operation, overcame the pressure of this cost-price squeeze. This was possible because of unlimited labor available to this level. Both managerial levels had accumulated a high level of outstanding debt created mainly by their purchases of land.

The introduction of cotton into the optimal solution was constrained in early years for both levels by the high investment capital requirements for a cotton picker. Thus, livestock and row crop enterprises requiring less investment capital were utilized until sufficient internal funds or borrowing capacity was available. The advent of cotton in the latter periods resulted in large land purchases and expansion of other capital intensive enterprises. Livestock enterprises declined as cotton was integrated into the optimal solution.

Optimal solutions for the established situation indicated that only the below average farmer would not succeed in maintaining a farm operation under the constraints imposed on this situation. The remaining three levels established stable operations after the first year, with row crops dominating the optimal solution. The only exception was the superior level, which expanded livestock enterprises throughout the period while continuing to operate a stable row crop operation. The absence of a labor constraint made this possible. All levels bought land, primarily utilizing internally generated capital for this and other investment alternatives. This was in contrast to the beginning situation in which heavy use of borrowed funds was necessary to initiate investment in land and machinery.

CONCLUSIONS

Certain conclusions were reached with respect to the impact of managerial ability on firm growth. In both situations, managers with below average managerial ability cannot succeed even under a situation of perfect certainty as assumed in these models. Without previous establishment in farming or inheritance of a farm, the average level cannot maintain a profitable operation due to low productivity and high capital requirements. The improved managerial level provided a basis for support of "family farm" operations because constraints imposed on this level could be successfully dealt with by farmers with improved managerial abilities. The superior manager represented the potential available when farming is subjected to management techniques similar to other businesses whereby the superior manager is a full-time manager and supervises the farm through hired supervisors and laborers. The primary deterrent to extensive development of farms managed by superior managers is the intensive use of capital under a situation of uncertainty with a high level of risk.

The net income potential of both beginning and established situations was similar, which was not expected. However, the beginning situation farmers utilized extensive borrowed capital for machinery and land purchases and were under·heavy debt loads, as opposed to the established situations where most investments for machinery were made with internally generated capital. Borrowed capital was utilized to supplement internally generated capital for land purchases by the established situation managers.

Thus, the net worth of the established situation managers was far superior to that of the beginning situation.

Managerial ability had a significant impact on the establishment and continued operation of farm firms. The degree of emphasis on managerial training and expertise must increase to meet the ever increasing complexities of American agriculture. If farmers are to succeed in establishing successful growth patterns, attention must be given to recognizing areas of weakness in farm management and strengthening these areas. Young farmers should concern themselves with adequately preparing for the future when sound farm business management will become increasingly necessary for success.

Continued research on the influence of managerial ability on firm growth will be necessary. Future models of firm growth could be improved to more accurately simulate the risks and uncertainties that exist in the real world. In addition, activities to allow for investment of farm profits in alternative investments, such as demand savings accounts and certificates, would provide the manager with alternatives for internally generated funds, thus forcing investments in the farm to yield returns competitive with nonfarm investment opportunities. Also, the multiperiod model could be improved by relaxing the assumption of perfect certainty through the inclusion of stochastic variables to allow for good and bad crop yields and random variation in prices.

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APPENDIX

APPENDIX TABLE 1. LABOR AVAILABILITY BY MANAGEMENT
LEVEL FOR SIX LABOR PERIODS

Period	Dates	Below average[1]	Average[2]	Improved[3]	Superior
1......	Dec. 1 — Feb. 10	976	1,438	1,900	unlimited
2......	Feb. 11 — Mar. 31	664	979	1,294	unlimited
3......	Apr. 1 — Apr. 30	409	603	797	unlimited
4......	May 1 — June 30	824	1,214	1,604	unlimited
5......	July 1 — Aug. 31	834	1,229	1,624	unlimited
6......	Sept. 1 — Nov. 30	1,233	1,817	2,401	unlimited

[1]Operator and one full-time hired man.
[2]Operator and two full-time hired men.
[3]Operator and three full-time hired men.
[4]Labor assumed available for all enterprises in the plan.

APPENDIX TABLE 2. PROJECTED RECEIPTS AND VARIABLE INPUT COSTS
USED IN THE INITIAL YEAR OF THE MULTIPERIOD MODEL

Enterprise	Receipts, by management level	
	Improved level[1]	Superior level
	Dollars	*Dollars*
Cotton, pound	0.52	0.52
Soybeans[2], bushel	5.50	5.50
Wheat, bushel	3.00	3.00
Corn, bushel	2.10	2.10
Stockers[3], pound	.40	.40
Market hogs[4], pound	.36	.36
	Variable costs, by management level	
	Improved level	Superior level
	Dollars	*Dollars*
Cotton, acre	177.23	194.95
Soybeans[5], acre	46.80	51.48
Soybeans[6], acre	50.15	55.17
Wheat, acre	45.66	50.23
Corn, acre	58.71	64.58
Stockers[7], unit	23,191.12	25,510.23
Stockers[8], unit	4,857.03	5,342.73
Farrow-finish hogs[9], unit	53,364.69	58,701.06
Market hogs[10], unit	70,149.36	77,164.30
Buy corn[11], bushel	2.50	2.50

[1]Receipts and variable costs were the same for the improved, below average, and average levels.
[2]Receipt price was the same for single and double-cropping enterprises.
[3]Receipt price was the same for both stocker enterprises.
[4]Receipt price was the same for both hog enterprises.
[5]Single-cropping enterprise.
[6]Double-cropping enterprise.
[7]Produced on silage (100 steers per unit).
[8]Produced on winter grazing (20 steers per unit).
[9]Corn fed not included (100 sows per unit).
[10]Corn fed not included (1,500 head per unit).
[11]Corn price was same for all levels due to assumed constant purchase price paid of 40 cents over the prevailing selling price for corn.

APPENDIX TABLE 3. COTTON, ESTIMATED COSTS AND RETURNS PER
ACRE, IMPROVED MANAGERIAL ABILITY, 1978

Item	Unit	Price or cost/unit	Quantity	Value or cost
Gross receipts				
Cotton lint	lb.	0.52	600.00	312.00
Cotton seed	ton	100.00	.50	50.00
TOTAL				362.00
Variable costs				
Preharvest				
Seed.........................	cwt.	33.00	.17	5.61
Fertilizer[1]	cwt.	7.50	2.50	18.75
Ammonium nitrate	cwt.	6.50	2.10	13.65
Lime	ton	12.00	.25	3.00
Herbicide	acre	10.88	1.00	10.88
Fungicide	acre	6.00	1.00	6.00
Insecticide	acre	3.29	14.00	46.06
Cotton scouting	acre	1.50	1.00	1.50
Machinery....................	acre	2.02	1.00	2.02
Tractors.....................	acre	17.60	1.00	17.60
Interest on operating capital....	dol.	.09	52.76	4.75
Subtotal, preharvest..........				129.82
Harvest costs				
Defoliant....................	acre	4.00	1.00	4.00
Ginning	bale	26.25	1.20	31.50
Machinery....................	acre	16.66	1.00	16.66
Subtotal, harvest				52.16
TOTAL VARIABLE COSTS				181.98
Income above variable costs				180.02
Fixed costs				
Machinery....................	acre	42.55	1.00	42.55
Tractors.....................	acre	17.63	1.00	17.63
TOTAL FIXED COSTS				60.18
Labor costs				
Preharvest labor (tractor & machinery)	hour	2.50	5.58	13.95
Harvest labor (tractor & machinery)	hour	2.50	1.31	3.27
TOTAL LABOR COSTS				17.22
TOTAL COSTS				259.38
Net returns to land and management..................				102.62

[1]Fertilizer rates used (90-60-60).

APPENDIX TABLE 4. SOYBEANS, ESTIMATED COSTS AND RETURNS PER ACRE, IMPROVED MANAGERIAL ABILITY, 1978

Item	Unit	Price or cost/unit	Quantity	Value or cost
Gross receipts				
Soybeans......................	bu.	5.50	30.00	165.00
TOTAL				165.00
Variable costs				
Preharvest				
Seed.........................	bu.	8.60	1.00	8.60
Fertilizer[1]	cwt.	6.12	2.00	12.24
Lime	ton	12.00	.25	3.00
Herbicide	acre	8.86	1.00	8.86
Insecticide	acre	6.71	1.00	6.71
Machinery....................	acre	.87	1.00	.87
Tractors......................	acre	3.81	1.00	3.81
Interest on operating capital....	dol.	.09	21.29	1.92
Subtotal, preharvest.........				46.01
Harvest costs				
Machinery....................	acre	2.72	1.00	2.72
Subtotal, harvest				2.72
TOTAL VARIABLE COSTS				48.73
Income above variable costs				116.27
Fixed costs				
Machinery....................	acre	19.74	1.00	19.74
Tractors......................	acre	4.04	1.00	4.04
TOTAL FIXED COSTS				23.78
Labor costs				
Preharvest labor (tractor & machinery)	hour	2.50	1.20	2.99
Harvest labor (tractor & machinery)	hour	2.50	.31	.77
TOTAL LABOR COSTS				3.76
TOTAL COSTS ....,.....				76.28
Net returns to land and management..................				88.72

[1]Fertilizer rates used (0-40-40).

APPENDIX TABLE 5. SOYBEANS (FOLLOWING WHEAT), ESTIMATED COSTS
AND RETURNS PER ACRE, IMPROVED MANAGERIAL ABILITY, 1978

Item	Unit	Price or cost/unit	Quantity	Value or cost
Gross receipts				
Soybeans....................	bu.	5.50	25.00	137.50
TOTAL				137.50
Variable costs				
Preharvest				
Seed........................	bu.	8.60	1.00	8.60
Fertilizer[1]	cwt.	6.12	2.00	12.24
Lime	ton	12.00	.33	3.96
Herbicide	acre	9.34	1.00	9.34
Insecticide	acre	8.62	1.00	8.62
Machinery...................	acre	.87	1.00	.87
Tractors.....................	acre	3.81	1.00	3.81
Interest on operating capital....	dol.	.09	19.72	1.78
Subtotal, preharvest				49.21
Harvest costs				
Machinery...................	acre	2.72	1.00	2.72
Subtotal, harvest				2.72
TOTAL VARIABLE COSTS				51.94
Income above variable costs				85.56
Fixed costs				
Machinery...................	acre	19.74	1.00	19.74
Tractors.....................	acre	4.04	1.00	4.04
TOTAL FIXED COSTS				23.78
Labor costs				
Preharvest labor (tractor & machinery)	hour	0	1.20	0
Harvest labor (tractor & machinery)	hour	0	.31	0
TOTAL LABOR COSTS				0
TOTAL COSTS				75.72
Net returns to land and management..................				61.78

[1]Fertilizer rates used (0-40-40).

APPENDIX TABLE 6. WHEAT, ESTIMATED COSTS AND RETURNS PER
ACRE, IMPROVED MANAGERIAL ABILITY, 1978

Item	Unit	Price or cost/unit	Quantity	Value or cost
Gross receipts				
Wheat	bu.	3.00	40.00	120.00
TOTAL				120.00
Variable costs				
Preharvest				
Wheat seed..................	bu.	7.75	1.25	9.69
Ammonium nitrate	cwt.	6.50	2.10	13.65
Fertilizer[1]	cwt.	7.50	2.50	18.75
Machinery....................	acre	.22	1.00	.22
Tractors.....................	acre	1.61	1.00	1.61
Interest on operating capital....	dol.	.09	24.64	2.22
Subtotal, preharvest				46.13
Harvest costs				
Machinery...................	acre	1.74	1.00	1.74
Subtotal, harvest				1.74
TOTAL VARIABLE COSTS				47.87
Income above variable costs				72.13
Fixed costs				
Machinery...................	acre	9.17	1.00	9.17
Tractors.....................	acre	1.42	1.00	1.42
TOTAL FIXED COSTS				10.59
Labor costs				
Preharvest labor (tractor &				
machinery)	hour	0	.71	0
Harvest labor (tractor &				
machinery)	hour	0	.35	0
TOTAL LABOR COSTS..........				0
TOTAL COSTS...............				58.47
Net returns to land and				
management..................				61.53

[1]Fertilizer rates used (90-60-60).

APPENDIX TABLE 7. CORN FOR GRAIN, ESTIMATED COSTS AND RETURNS PER ACRE, IMPROVED MANAGERIAL ABILITY, 1978

Item	Unit	Price or cost/unit	Quantity	Value or cost
Gross receipts				
Corn........................	bu.	2.10	70.00	147.00
TOTAL				147.00
Variable costs				
Preharvest				
Seed........................	lb.	.67	10.00	6.70
Fertilizer[1]	cwt.	7.50	1.70	12.75
Nitrogen	cwt.	6.50	3.20	20.80
Lime	ton	12.00	.33	3.96
Herbicide	acre	6.94	1.00	6.94
Machinery...................	acre	1.14	1.00	1.14
Tractors.....................	acre	4.69	1.00	4.69
Interest on operating capital....	dol.	.09	27.44	2.47
Subtotal, preharvest.........				59.45
Harvest costs				
Machinery...................	acre	1.74	1.00	1.74
Subtotal, harvest				1.74
TOTAL VARIABLE COSTS				61.19
Income above variable costs				85.81
Fixed costs				
Machinery...................	acre	14.35	1.00	14.35
Tractors.....................	acre	4.67	1.00	4.67
TOTAL FIXED COSTS				19.01
Labor costs				
Preharvest labor (tractor & machinery)	hour	2.50	1.49	3.72
Harvest labor (tractor & machinery)	hour	2.50	.35	.88
TOTAL LABOR COSTS				4.60
TOTAL COSTS				84.80
Net returns to land and management.................				62.20

[1]Fertilizer rates used (120-40-40).

APPENDIX TABLE 8. CORN FOR SILAGE, ESTIMATED COSTS PER
ACRE, IMPROVED MANAGERIAL ABILITY, 1978

Item	Unit	Price or cost/unit	Quantity	Value or cost
Gross receipts				
Silage.........................	tons	0	14.00	0
TOTAL				0
Variable costs				
Preharvest				
Seed..........................	lb.	.67	12.00	8.04
Fertilizer[1]	cwt.	7.50	2.90	21.75
Nitrogen	cwt.	6.50	4.75	30.88
Lime	ton	12.00	.33	3.96
Herbicide	acre	6.94	1.00	6.94
Machinery.....................	acre	1.14	1.00	1.14
Tractors.......................	acre	4.69	1.00	4.69
Interest on operating capital....	dol.	.09	30.38	2.73
Subtotal, preharvest				80.13
Harvest costs				
Machinery.....................	acre	3.12	1.00	3.12
Tractors.......................	acre	2.56	1.00	2.56
Subtotal, harvest				5.68
TOTAL VARIABLE COSTS				85.81
Income above variable costs				-85.81
Fixed costs				
Machinery.....................	acre	16.95	1.00	16.95
Tractors.......................	acre	6.86	1.00	6.86
TOTAL FIXED COSTS				23.81
Labor costs				
Preharvest labor (tractor &				
machinery)	hour	2.50	1.49	3.72
Harvest labor (tractor &				
machinery)	hour	2.50	.90	2.25
TOTAL LABOR COSTS				5.97
TOTAL COSTS				115.60
Net returns to land and				
management..................				-115.60

[1]Fertilizer rates used (180-70-70).

APPENDIX TABLE 9. STOCKER BUDGET, ESTIMATED COSTS AND RETURNS PER UNIT (20 STEERS), IMPROVED MANAGERIAL ABILITY, 1978

Item	Unit	Price or cost/unit	Quantity	Value or cost
Gross receipts				
Steer calves (700 lb.)	cwt.	40.00	20.00	5,600.00
TOTAL				5,600.00
Variable costs				
Steer calves	cwt.	40.00	4.25	3,400.00
Pasture[1]	acre	60.48	.80	967.68
Salt & mineral	cwt.	4.00	.45	36.00
Hay	acre	133.25	.05	133.25
Veterinarian and medical	head	6.00	1.00	120.00
Custom hauling	head	.75	2.00	30.00
Sales commission	head	8.40	1.00	168.00
Equipment (fuel, lube, repairs)..	dol.			2.10
Interest on operating capital....	dol.	.09	2,690.29	242.13
TOTAL VARIABLE COSTS				5,099.16
Income above variable costs				500.84
Fixed costs				
Coastal hay..................	dol.	68.01	1.00	68.01
Ryegrass-clover	dol.	6.36	16.00	101.76
Interest on other equipment	dol.	.09	87.50	7.87
Depreciation on other				
equipment	dol.			7.00
Other farm machinery &				
equipment	dol.			6.12
TOTAL FIXED COSTS				190.76
TOTAL COSTS................				5,289.92
Net returns				310.08

[1]Utilizing rye, ryegrass, and clover grazing.

APPENDIX TABLE 10. STOCKER BUDGET, ESTIMATED COSTS AND RETURNS PER UNIT (100 STEERS), IMPROVED MANAGERIAL ABILITY, 1978

Item	Unit	Price or cost/unit	Quantity	Value or cost
Gross receipts				
Steer calves (700 lb.)	cwt.	40.00	100.00	28,000.00
TOTAL				28,000.00
Variable costs				
Steer calves	cwt.	40.00	4.25	17,000.00
Corn silage	acre	85.81	16.10	1,381.54
Salt & mineral	cwt.	4.00	.45	180.00
Corn.........................	acre	61.19	9.20	562.95
Protein supplement............	cwt.	11.25	2.70	3,037.50
Custom hauling	head	.75	2.00	150.00
Sales commission	head	8.40	1.00	840.00
Veterinarian & medicine	head	6.00	1.00	600.00
Equipment (fuel, lube, repairs)				2.10
Interest on operating capital....	dol.	.09	15,473.45	1,392.61
TOTAL VARIABLE COSTS				25,146.70
Income above variable costs				2,853.30
Fixed costs				
Corn silage	dol.	24.16	16.10	388.98
Corn.........................	dol.	19.36	9.20	178.11
Interest on other equipment	dol.	.09	87.50	7.87
Depreciation on other equipment	dol.			7.00
Other farm machinery & equipment	dol.			6.12
TOTAL FIXED COSTS				588.08
TOTAL COSTS...............				25,734.78
Net returns				2,265.22

[1]Utilizing produced corn silage.

APPENDIX TABLE 11. RYE, RYEGRASS, AND CLOVER FOR WINTER GRAZING, ESTIMATED COSTS PER ACRE, IMPROVED MANAGERIAL ABILITY, 1978

Item	Unit	Price or cost/unit	Quantity	Value or cost
Gross receipts				
TOTAL				0
Variable costs				
Preharvest				
Rye..........................	bu.	8.95	1.00	8.95
Ryegrass seed	lb.	.25	15.00	3.75
Clover seed	lb.	2.11	5.00	10.55
Fertilizer[1]	cwt.	7.50	2.50	18.75
Ammonium nitrate	cwt.	6.50	1.60	10.40
Machinery....................	acre	.76	1.00	.76
Tractors.....................	acre	2.94	1.00	2.94
Interest on operating capital....	dol.	.09	48.72	4.39
Subtotal, preharvest				60.48
Harvest costs				
Subtotal, harvest				0
TOTAL VARIABLE COSTS				60.48
Income above variable costs				-60.48
Fixed costs				
Machinery....................	acre	2.47	1.00	2.47
Tractors.....................	acre	3.89	1.00	3.89
TOTAL FIXED COSTS				6.36
Labor costs				
Preharvest labor (tractor &				
machinery)	hour	2.50	.82	2.06
TOTAL LABOR COSTS..........				2.06
TOTAL COSTS................				68.91
Net returns to land and				
management..................				-68.91

[1]Fertilizer rates used (75-60-60).

APPENDIX TABLE 12. COASTAL BERMUDA FOR HAY, ESTIMATED ESTABLISHMENT COSTS PER ACRE, IMPROVED MANAGERIAL ABILITY, 1978

Item	Unit	Price or cost/unit	Quantity	Value or cost
Gross receipts				
TOTAL				0
Variable costs				
Preharvest				
Sprigs[1]	bu.	.50	30.00	15.00
Fertilizer[2]	cwt.	6.12	2.00	12.24
Ammonium nitrate	cwt.	6.50	2.70	17.55
Lime	ton	12.00	1.00	12.00
Machinery....................	acre	1.27	1.00	1.27
Tractors.....................	acre	3.67	1.00	3.67
Interest on operating capital....	dol.	.09	26.20	2.36
Subtotal, preharvest				64.09
Harvest costs				
Subtotal, harvest				0
TOTAL VARIABLE COSTS				64.09
Income above variable costs				-64.09
Fixed costs				
Machinery....................	acre	9.08	1.00	9.08
Tractors.....................	acre	4.11	1.00	4.11
TOTAL FIXED COSTS				13.19
Labor costs				
Preharvest labor (tractor &				
machinery)	hour	2.50	1.14	2.86
TOTAL LABOR COSTS				2.86
TOTAL COSTS................				80.14
Net returns to land and				
management..................				-80.14

[1]Clippings can be substituted for sprigs — cost may change.
[2]Fertilizer rates used (90-40-40).

APPENDIX TABLE 13. COASTAL BERMUDA FOR HAY, ESTIMATED ANNUAL COSTS
AND RETURNS PER ACRE, IMPROVED MANAGERIAL ABILITY, 1978

Item	Unit	Price or cost/unit	Quantity	Value or cost
Gross receipts				
Bermuda	ton	0	6.00	0
TOTAL				0
Variable costs[1]				
Preharvest				
Fertilizer[2]	cwt.	6.12	5.00	30.60
Ammonium nitrate	cwt.	6.50	9.00	58.50
Lime	ton	12.00	.25	3.00
Seasonal labor	hour	2.50	3.00	7.50
Machinery...................	acre	.05	1.00	.05
Tractors.....................	acre	.69	1.00	.69
Interest on operating capital....	dol.	.09	27.74	2.50
Subtotal, preharvest				102.84
Harvest costs				
Machinery...................	acre	13.73	1.00	13.73
Tractors.....................	acre	16.68	1.00	16.68
Subtotal, harvest				30.41
TOTAL VARIABLE COSTS				133.25
Income above variable costs				-133.25
Fixed costs				
Machinery...................	acre	44.10	1.00	44.10
Tractors.....................	acre	15.01	1.00	15.01
Prorated establishment cost	acre	80.13	.10	8.01
TOTAL FIXED COSTS				67.12
Labor costs				
Preharvest labor (tractor &				
machinery)	hour	2.50	.22	.56
Harvest labor (tractor &				
machinery)	hour	2.50	9.85	24.64
TOTAL LABOR COSTS..........				25.20
TOTAL COSTS................				225.57
Net returns to land and				
management..................				-225.57

[1]For establishment costs, see the coastal bermuda hay establishment budget.
[2]Fertilizer rates used (300-100-100).

APPENDIX TABLE 14. 100 SOW BUDGET, FARROW-FINISH[1], ESTIMATED COSTS AND RETURNS, IMPROVED MANAGERIAL ABILITY, 1978

Item	Unit	Price or cost/unit	Quantity	Value or cost
Gross receipts				
Slaughter hogs (220 lb.)	cwt.	36.00	1,606.00	127,195.20
Sows (300 lb.)	cwt.	28.00	60.00	5,040.00
Boar (400 lb.)	cwt.	21.00	4.00	336.00
TOTAL				132,571.20
Variable costs				
Corn.	bu.	2.50	23,000.00	57,500.00
Protein supplement.	ton	280.00	124.00	34,720.00
Creep.	ton	295.00	24.00	7,080.00
Truck hauling	head	.50	1,670.00	835.00
Veterinarian and medicine	head	1.00	1,790.00	1,790.00
Utilities	head	500.00	12.00	6,000.00
Repairs	dol.	1.00	350.00	350.00
Boar	head	350.00	4.00	1,400.00
Equipment (fuel, lube, repairs) .	dol.			1,190.00
Interest on operating capital. . . .	dol.	.09	53,514.91	4,816.34
TOTAL VARIABLE COSTS				115,681.34
Income above variable costs				16,889.86
Fixed costs				
Interest on livestock capital	dol.	.09	13,399.99	1,206.00
Interest on other equipment	dol	.09	34,499.99	3,105.00
Depreciation on other equipment	dol.			4,075.00
Other fixed costs, machinery & equipment	dol.			2,414.98
TOTAL FIXED COSTS				10,800.98
TOTAL COSTS.				126,482.32
Net returns[2]				6,088.88

[1]Complete confinement, buying all corn fed, assuming an 80 percent conception rate, 8.5 pigs weaned per litter, and a 2 percent death loss from weaning to market.
[2]Net returns to operator's land, labor, and management.

APPENDIX TABLE 15. MARKET HOGS[1], COSTS AND RETURNS PER 1,500-HEAD
UNIT, IMPROVED MANAGERIAL ABILITY, 1978

| Item	Unit	Price or cost/unit	Quantity	Value or cost
Gross receipts				
Slaughter hogs (220 lb.)	cwt.	36.00	1,470.00	116,424.00
TOTAL				116,424.00
Variable costs				
Corn.........................	bu.	2.50	14,106.00	35,265.00
Protein supplement............	ton	280.00	70.53	19,748.40
Feeder pigs	head	30.00	1,500.00	45,000.00
Truck hauling	head	.50	2,970.00	1,485.00
Veterinarian & medicine	head	.50	1,500.00	750.00
Equipment (fuel, lube, repairs)	dol.			165.97
Interest on operating capital....	dol.	.09	45,158.00	4,064.22
TOTAL VARIABLE COSTS				106,478.59
Income above variable costs				9,945.41
Fixed costs				
Interest on other equipment	dol.	.09	5,472.49	492.52
Depreciation on other equipment	dol.			901.96
Other fixed costs, machinery & equipment	dol.			383.07
TOTAL FIXED COSTS				1,777.55
TOTAL COSTS................				108,256.14
Net returns[2]				8,167.86

[1]Dry lot finishing operation, buying all corn fed, 2 percent death loss from weaning to market, 3.7 pounds feed per pound gain.
[2]Net returns to operator's land, labor, and management.

Alabama's Agricultural Experiment Station System
AUBURN UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.
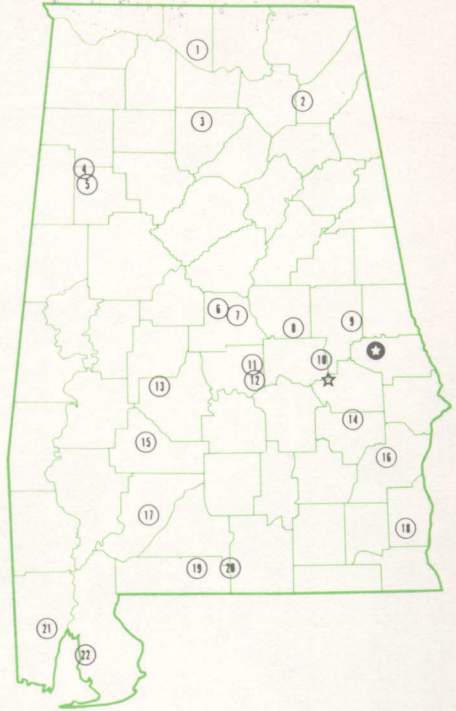
Research Unit Identification

⊛ Main Agricultural Experiment Station, Auburn.
☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. The Turnipseed-Ikenberry Place, Union Springs.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
19. Brewton Experiment Field, Brewton.
20. Solon Dixon Forestry Education Center, Covington and Escambia counties.
21. Ornamental Horticulture Field Station, Spring Hill.
22. Gulf Coast Substation, Fairhope.