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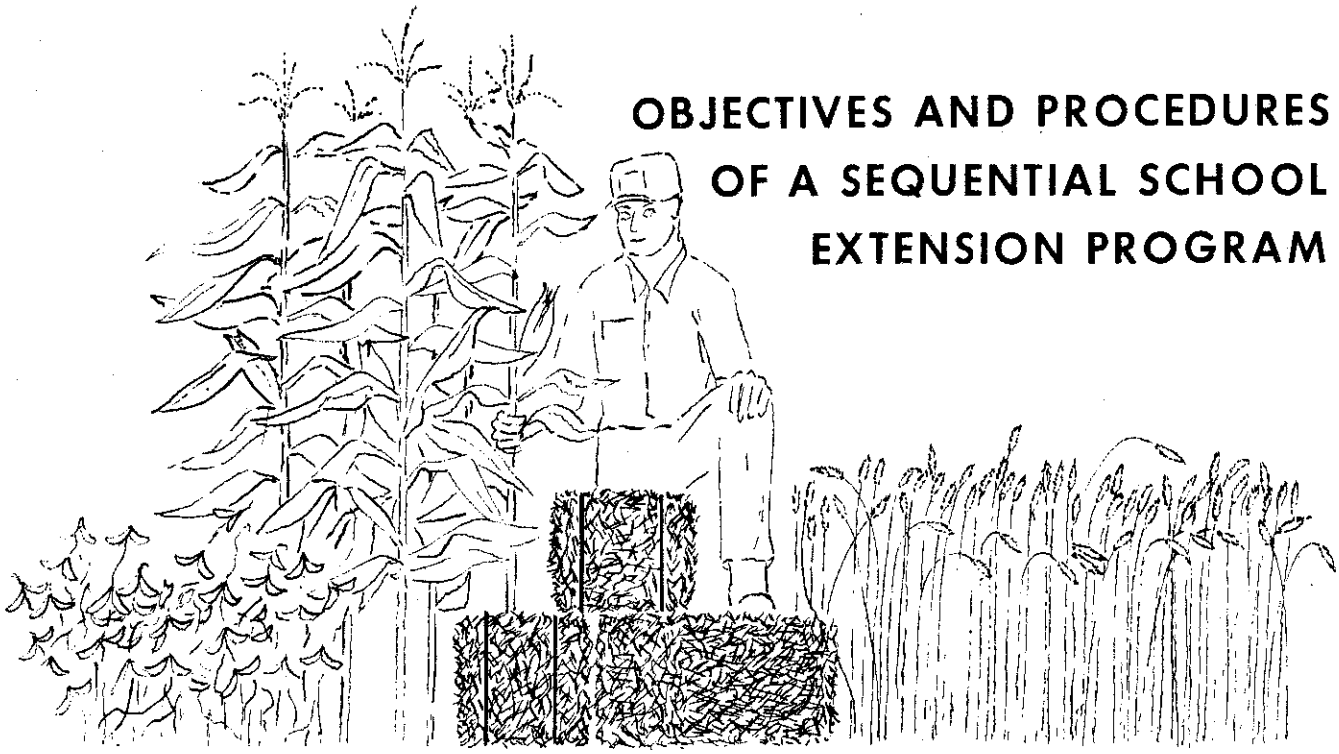
PROFITABLE COMBINATIONS OF CASH CROP ENTERPRISES



OBJECTIVES AND PROCEDURES OF A SEQUENTIAL SCHOOL EXTENSION PROGRAM

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Charles Smith, Carol McNeil and Larry Davis, Regional Cooperative Extension Specialists helped to organize the pilot school at Canandaigua, New York.

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As always, all remaining omissions or errors are the responsibility of the authors.

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INTRODUCTION

In the past few years there has been a major research and extension effort in enterprise analysis and organization at Cornell University. Enterprise analysis is a means of examining a farming operation by intensively looking at its parts and how the combination of those parts impacts on profitability. On a cash crop farm, the parts examined the different crop enterprises grown. Using enterprise analysis, farm managers can find the weak links or enterprises in their operation and determine crop enterprise combinations which would be more profitable given the labor, field machinery and land resources available.

The extension efforts in enterprise analysis focus primarily on those farms that are not expanding. The program is designed to assist managers of these farms in finding more profitable ways of utilizing their resources. This program could help a farm manager who had already decided to expand by assisting him in developing the most profitable enterprise combinations for the expanded operation.

The approach of looking at how to better organize the enterprises in the current operation is especially relevant in a year with shrinking price-cost margins or dramatically changing input costs and output prices. The best way to avoid a substantial decrease in income is to better combine and manage crop enterprises given the resources that are available and unique to an individual farm. The Profitable Combination of Cash Crop Enterprises program is a decision-aid which can help a farm manager answer such questions as:

What combination of corn, beans, or other alternative crops will maximize profit this year? Over the long run?

What size machinery and equipment is needed?

What are the economic gains from timeliness with larger capacity machines?

Can I operate additional land with my present sized machinery?

What is the impact of a government acreage diversion program on my cropping program?

The computer model gives a farm manager a planning budget; that is, an estimate of what profit would be over a planning horizon of at least one crop year. It does not give a day to day operating plan. The main objective is to formulate a working plan based upon individual manager <u>expectations</u> with respect to machinery performance rates for land preparations, planting and harvesting; expected number of working days; and prices. In practice, of course, above and below average seasons are realized and planting and/or harvest plans will have to be adjusted.

PURPOSE OF REPORT

The purpose of this report is to set forth the objectives and procedures of a three-day advanced farm management school on Profitable Combination of Cash Crop Enterprises including the outline of each day's activities, discussion of worksheets used, and interpretation of output. This report should better prepare one for making the decision whether or not to conduct such a school in their county or multi-county area and also provide a basis for conducting such a school.

OBJECTIVES OF SEQUENTIAL SCHOOL

There are three main objectives of the sequential school. The first objective is to improve the farmer participants' understanding of the importance, construction and use of enterprise budgets. A second objective is to develop this understanding by constructing enterprise budgets for each participant's farm. The third objective is to further develop this understanding by determining the best combination of cash crop enterprises given the participant's unique set of circumstances and available resources.

PILOT SEQUENTIAL SCHOOL

A pilot sequential school was conducted in February and March 1979 in Canandaigua, New York. Farmers from seven different farms attended. In addition to the authors, three regional cooperative extension specialists, Charles Smith, Carol McNeil and Larry Davis, participated in and were of great assistance in conducting the school.

In general, the format and worksheets presented in this report are those used in the pilot sequential school. This material has also been used in classroom instruction at Cornell. A summary of the farmer evaluations is contained in Appendix A.

PROCEDURES

The sequential school is conducted in three full-day sessions. The pilot school was held on consecutive Tuesdays from 9:30 a.m. until 3:30 p.m. The cooperating agents sent a blanket invitation to their area and followed up with specific farmers. This school is definitely an advanced farm management school; a good set of records is essential. A fee of $40 per farm was charged to cover costs of refreshments, computer time, and long distance telephone calls necessary for remote terminal operation.

OUTLINE OF SEQUENTIAL SCHOOL

A proposed outline for each day of the sequential school is contained in Table 1. This outline is for sessions beginning at 9:30 a.m. (after 30 minutes of coffee, doughnuts and discussion) and adjourning at 3:30 p.m. For different starting and ending times appropriate adjustments can be made. The morning of the first day sets the stage for what is to follow. The objectives of the school, an outline of what will be done during each of the three days, and the importance and use of enterprise budgets are covered. A relatively elementary example and a more complex example using the computer program for enterprise combinations were used in the pilot school. The afternoon of the first day and all day the second day is spent in workshop sessions. Obtaining prices, costs, restrictions and input-output coefficients for the crop enterprises is accomplished using a set of worksheets which are discussed in the next section of this report. After the second day, the worksheets are complete. The first analysis is then run on campus between the second and third sessions.

On the third day, a presentation of how the computer arrives at the solution and a discussion and interpretation of each participant's output is conducted. Later, an opportunity for adjusted analyses and further interpretation of the output is given each participant. Each farm manager discussed the management implications of his computer output with a school leader who had reviewed the output beforehand.

A potential bottleneck at the third session is running adjusted analyses on a remote terminal. With a larger enrollment the participants should be divided into two groups. The first group would arrive at 9:00 a.m. and the second group at 12:30 p.m. Although the time both groups are in attendance may overlap, the first group would be finished before the second group is ready to do adjusted analyses. With even larger enrollments, the groups could come on separate days.

In the following section, major items on the agenda are discussed. The materials and worksheets used are included and discussed briefly. Additional information is included in the appendices.

IMPORTANCE AND USE OF ENTERPRISE ANALYSIS

The discussion of "Importance and Use of Enterprise Analysis" in the school had three parts:

1. The general topic of an enterprise and enterprise analysis is introduced largely through a simple example.
2. The enterprise budgets contained in An Economic Analysis of New York Dairy Farm Enterprises[1/] are used to describe the procedure used in constructing enterprise budgets and to illustrate their usefulness.

[1/] A. E. Research 78-1 by Wayne A. Knoblauch, Robert A. Milligan and Merri L. Woodell. Copies of this reference and updated versions are readily available from one of the authors. This publication was prepared for use in all budget work.

Table 1. A Suggested Agenda for a Sequential School on Profitable Combination of Cash Crop Enterprises.

		First Day
9:00 - 9:30	I.	Coffee and doughnuts
9:30 - 10:30	II.	Introduction of participants by host agents
	III.	Objectives of the school
	IV.	Outline of each days activities
10:30 - 10:40	V.	Discussion of enterprise budgets and enterprise analysis
		A. What is an enterprise?
		B. What is an enterprise budget?
		C. What is enterprise analysis?
10:40 - 11:00	VI.	Example computer program output
		A. Information contained in the output
		B. How it can be used in decision making
11:00 - 12:00	VII.	Workshop on enterprises and restrictions
		A. What enterprises should be considered?
		B. What land resource restrictions do I have?
12:00 - 1:00	VIII.	LUNCH
1:00 - 3:00	IX.	Workshop on variable expenses
		A. Major crops: corn grain, soybeans or dry beans
		B. Minor crops: wheat, hay, sunflower, cabbage, others
3:00 - 3:30	X.	Preview of second day
		What additional information is needed?
		Second Day
9:00 - 9:30	I.	Coffee and doughnuts
9:30 - 10:00	II.	Workshop to refine variable expense data not completed from the first day

Table 1. (continued)

Second Day (continued)

10:00 - 12:00	III.	Workshop on machinery efficiency
		A. Land preparation
		B. Planting
		C. Harvesting
		D. Which operations are performed for each crop
		E. When is the operation performed for minor crops
12:00 - 1:00	IV.	LUNCH
1:00 - 3:00	V.	Workshop on labor and machine availability
		A. Hours available for field work
		B. Number of machines
3:00 - 3:15	VI.	Workshop on drying costs and storage capacity
3:15 - 3:30	VII.	Discussion of fixed expenses

Third Day

9:00 - 9:30	I.	Coffee and doughnuts
9:30 - 10:00	II.	Example of graphically solving an enterprise combination problem (3 input - 2 output linear programming example)
10:00 - 10:30	III.	Participants are given first output and a review of its interpretation.
10:30 - 12:00	IV.	One-to-one workshop with adjusted analyses and implementation discussion
12:00 - 1:00	V.	LUNCH
1:00 - 2:30	VI.	Continuation of morning workshop and adjusted analyses
2:30 - 3:00	VII.	Evaluation of the school

3. A more complete and realistic farm situation is described and the output for this farm is discussed, enter Clyde Cashcropper. This discussion gives the participants an understanding of the information that must be collected and a familiarity with the output they will receive.

The example, referred to as Clyde Cashcropper, used to introduce the concept of enterprise analysis and output is contained on the following pages. These pages also illustrate the worksheets used to collect the required information.

WORKSHOP ON ENTERPRISES, RESTRICTIONS AND VARIABLE EXPENSES

The purpose of these workshops, which occupy the late morning and afternoon of the first day, is to gather information on crop enterprises to be considered, land availability, variable costs, yields and prices. In this portion we begin to refer to corn and beans as the major crops and other crops as minor crops. This terminology is used because corn and beans compete directly with each other for time and machinery for land preparation, planting and harvesting in both spring and fall.

The Crop Acreage, Restrictions and Enterprises worksheet (page 7) and the enterprise worksheets (pages 9-18 and similar worksheets for oats, other small grains, and miscellaneous crops) are completed in this workshop. The farmers were asked to compile information to be used for these worksheets in advance and to bring their farm records. Final adjustments are completed at the second session.

It is important here to select the relevant variable costs for all enterprises. Since we are planning for the next year, current or projected prices should be used instead of last years. For the major crops the total selected variable expenses are used to determine the amount of these crops to be grown. For the other crops the Net Returns/Acre is used as the program assumes constant returns for these crops. In this workshop the importance of variable costs are discussed and examples used to determine the differences between fixed and variable costs.

WORKSHOP ON MACHINERY EFFICIENCY

The Inventory of Primary and Secondary Tillage, Planting and Harvesting Operations (page 19) is used for each farm manager to identify all of his primary and secondary tillage, planting and harvesting operations. For each operation machine size, field speed and average field efficiency are determined. An average field capacity is then calculated. This information is then used to identify field operations and capacities for major crops (page 21) and time schedules for alternative crops (page 25). The important points are to identify which operation is to be performed on the major crops and when operations will be performed on the minor crops. See also Appendices B, Time Available and Timeliness of Field Operations, and C, Field Capacity.

Name Clyde Cashcropper

PROFITABLE COMBINATION OF CASH CROP ENTERPRISES

CROP ACREAGE, RESTRICTIONS, AND ENTERPRISES

Type I or ~~Owned or~~ Best Crop Acres 500 Corn Maximum Acres 600

Type II or ~~Rented or~~ Better Crop Acres 500 Corn Minimum Acres 0

Beans, Soy Maximum Acres 1000

Beans, Soy Minimum Acres 0

MAJOR CROPS

	Land Type	Acreage Restrictions		
	1 or 2 or both	Maximum	Exact	Minimum
Corn	1	500		
Corn	2	300		
Beans, Soy	1	500		
Beans, Soy	2	500		

MINOR CROPS

1	Hay	1			
2	Hay	2			
3	Wheat	1			
4	Wheat	2			
5					
6					

 Name Clyde Cashcropper

PROFITABLE COMBINATION OF CASH CROP ENTERPRISES

ENTERPRISE WORKSHEET: CORN GRAIN BUDGET

Yield Per Acre, bu.: Type I or owned 100 (02a) Type II or rented 85 (03a)

Price, $/bu. at harvest 2.25 (70a)

Price, $/bu. in spring (net of storage costs) 2.40 (70b)

Selected Variable Expense	Type I or Owned: Units Required	Type I or Owned: Cost per Unit	Type I or Owned: Per Acre Expense	Type II or Rented Per Acre Expense
Seed				
Fertilizer:				
Nitrogen				
Phosphorus, P_2O_5				
Potassium, K_2O				
Manure, lime, cover crop				
Herbicide, _____				
_____				
Insecticide, _____				
_____				
Fungicide, _____				
_____				
Power & Equipment:				
Fuel, Oil, Grease				
Repairs & Maintenance (does not include depreciation)				
Crop Insurance				
Other (Soil & plant analysis, pest management service, ...)				
Custom Work Hired:				
Fertilizer spreading				
Spraying				
_____				
_____				
Hired Labor				
Marketing				
Total			95	85
Interest on Operating Capital				
Total (from above) ÷ 2	= 47.50		42.50	
Short-term interest rate	x .095		.095	
Interest on Operating Capital	=		4.50	4.05
TOTAL SELECTED VARIABLE EXPENSES			99.50 (02b)	89.05 (03b)

 Name Clyde Cashcropper

PROFITABLE COMBINATION OF CASH CROP ENTERPRISES

ENTERPRISE WORKSHEET: SOYBEANS BUDGET

Yield Per Acre, bu.: Type I or owned 30 (04a) Type II or rented 25 (05a)

Price, $/bu. at harvest 6.00 (71a)

Price, $/bu. in spring (net of storage costs) 6.40 (71b)

Selected Variable Expense	Type I or Owned: Units Required	Type I or Owned: Cost per Unit	Type I or Owned: Per Acre Expense	Type II or Rented Per Acre Expense
Seed				
Fertilizer:				
Nitrogen				
Phosphorus, P_2O_5				
Potassium, K_2O				
Manure, lime, cover crop				
Herbicide,				
Insecticide,				
Fungicide,				
Power & Equipment:				
Fuel, Oil, Grease				
Repairs & Maintenance (does not include depreciation)				
Crop Insurance				
Other (Soil & plant analysis, pest management service, ...)				
Custom Work Hired:				
Fertilizer spreading				
Spraying				
Hired Labor				
Marketing				
Total			80	60
Interest on Operating Capital				
Total (from above) ÷ 2	= 40			30
Short-term interest rate	x .095			.095
Interest on Operating Capital	=		3.80	2.85
TOTAL SELECTED VARIABLE EXPENSES			83.80 (04b)	62.85 (05b)

 Name _____

PROFITABLE COMBINATION OF CASH CROP ENTERPRISES

ENTERPRISE WORKSHEET: DRY BEAN BUDGET

Yield Per Acre, cwt.: Type I or owned _____(04a) Type II or rented _____(05a)

Price, $/cwt. _____(71a)

Selected Variable Expense	Type I or Owned: Units Required	Type I or Owned: Cost per Unit	Type I or Owned: Per Acre Expense	Type II or Rented Per Acre Expense
Seed				
Fertilizer:				
Nitrogen				
Phosphorus, P_2O_5				
Potassium, K_2O				
Manure, lime, cover crop				
Herbicide, _____				
_____				
Insecticide, _____				
_____				
Fungicide, _____				
_____				
Power & Equipment:				
Fuel, Oil, Grease				
Repairs & Maintenance (does not include depreciation)				
Crop Insurance				
Other (Soil & plant analysis, pest management service, ...)				
Custom Work Hired:				
Fertilizer spreading				
Spraying				
_____				
_____				
Hired Labor				
Marketing				
Total				
Interest on Operating Capital				
Total (from above) ÷ 2	=			
Short-term interest rate	x			
Interest on Operating Capital	=			
TOTAL SELECTED VARIABLE EXPENSES				

(04b) (05

Name Clyde Cashcropper

PROFITABLE COMBINATION OF CASH CROP ENTERPRISES

ENTERPRISE WORKSHEET: HAY BUDGET

Note: In the preparation of this worksheet be certain to count only those cash expenses and uses of labor in critical periods that apply to this particular year. For example, in a three year rotation only one-third of the acres will be planted and require extensive tillage operations but these expenses must be allocated to all of the acres. Also, the yield per acre will probably differ in relation to the age of a particular stand of hay. Keep in mind we are interested in per acre expenses and labor requirements. You may wish to use a typical year in the first analysis and then do the transition period in an adjusted analysis.

Selected Variable Expense	Units Required	Cost per Unit	Per Acre Expense
Seed			
Fertilizer:			
Nitrogen			
Phosphorus, P_2O_5			
Potassium, K_2O			
Manure, lime			
Chemicals, _____			
_____			
Power & Equipment:			
Fuel, Oil, Grease			
Repairs & Maintenance (does not include depreciation)			
Other (Soil & plant analysis, crop insurance, ...)			
Custom Work hired:			
Fertilizer spreading			
Spraying			
_____			
_____			
Hired Labor			
Marketing			
Total			55

Interest on Operating Capital

Total (from above) ÷ 2	=	27.50
Short-term interest rate	x	.095
Interest on Operating Capital	=	2.60

TOTAL SELECTED VARIABLE EXPENSES 57.60

This worksheet is continued on the backside of this page.

Age of Stand	Percentage of Total Hay Acreage This Age		Yield Per Acre Tons/Acre	Weighted Average Yield Tons/Acre
1st year	30	x	3.0	.9
2nd year	30	x	4.5	1.35
3rd year	30	x	4.0	1.2
additional years	10	x	2.0	.2
			Total	3.65
Price, $/Ton				60
Gross Returns/Acre (Price x weighted ave. yield)				219
Variable Cost/Acre (from front of page)				57.60
Net Return/Acre				161.40

Name Clyde Cashcropper

PROFITABLE COMBINATION OF CASH CROP ENTEPPRISES

ENTERPRISE WORKSHEET: WHEAT BUDGET

Selected Variable Expense	Units Required	Cost per Unit	Per Acre Expense
Seed			
Fertilizer:			
Nitrogen			
Phosphorus, P_2O_5			
Potassium, K_2O			
Manure, lime, cover crop			
Herbicide, _____			
_____			
Insecticide, _____			
_____			
Fungicide, _____			
_____			
Power & Equipment:			
Fuel, Oil, Grease			
Repairs & Maintenance (does not include depreciation)			
Crop Insurance			
Other (Soil & plant analysis, pest management service,...)			
Custom Work hired:			
Fertilizer spreading			
Spraying			
_____			
_____			
Hired Labor			
Marketing			
Total			50

Interest on Operating Capital

Total (from above) ÷ 2	=	
Short-term interest rate	x	
Interest on Operating Capital	=	2.40

TOTAL SELECTED VARIABLE EXPENSES 52.40

This worksheet is continued on the backside of this page.

Yield Per Acre, bu.	45	
Price, $/bu.	x 3.50	
Returns from Grain	= 157.50	157.50
Straw, amount per acre	1	
Price	x 50	
Returns from Straw	= 50	50
Gross Returns/Acre		207.50
Variable Costs/Acre		(52.40)
Net Return/Acre		155.10

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PROFITABLE COMBINATION OF CASH CROP ENTERPRISES
INVENTORY OF PRIMARY AND SECONDARY TILLAGE,
PLANTING AND HARVESTING OPERATIONS

Field Operation	Machine or Equipment Size (Width in ft. or inches)	Field Speed (mph)	Ave. Field Efficiency (Decimal)	Field Capacity (Acres/hr.)
Primary Tillage				
Chisel plow	13'	5.0	.80	6.3
Secondary Tillage				
Tandem disc	16'	4.5	.80	7.0
Springtooth	20'	5.5	.80	10.7
Planting				
6-30" Drill	180"	4.5	.65	5.3
	11'	3.5	.75	3.5
Harvesting				
Corn	6-30"	180"	3.0	.60	3.3
Wheat	13'	13'	3.5	.70	3.9
Soy	5-30"	150"	3.0	.70	3.2

Name Clyde Cashcropper

PROFITABLE COMBINATION OF CASH CROP ENTERPRISES

FIELD OPERATIONS FOR MAJOR CROPS

Field Operation	Corn		Beans, Soy	
	Acres/Hour		Acres/Hour	
Primary Tillage				
Fall Chisel	6.3	.16	6.3	
Fert. application	33	.03		
Total Hours/Acre	5.26 =	1/.19	6.3 =	1/.16
Spring				
Total Hours/Acre				
Secondary Tillage				
Disc	7.0		7.0	.14
Springtooth			10.7	.09
				.230
Total Hours/Acre	7.0		4.2	
Planting				
	5.3		5.9	
Total Hours/Acre				
Harvesting				
Total Hours/Acre	3.3		3.2	

Name Clyde Cashcropper

PROFITABLE COMBINATION OF CASH CROP ENTERPRISES

TIME AVAILABILITY FOR FIELD OPERATIONS ON MAJOR CROPS

Labor Period	No. of Machine/Men		No. of Hrs. Worked Per Day		No. of Days Available for Field Work		Total Hours Available		Allocation of Total Hours Available: Land Preparation		Planting		Harvesting
1 April 1-April 20	2	x	8	x	4.1	=	65.6	=	66	+	X	+	X
2 April 21-April 30	2	x	8	x	3.3	=	52.8	=	53	+	26	+	X T
3 May 1-May 10	2	x	10	x	3.6	=	72.0	=	72	+	36	+	X T
4 May 11-May 20	2	x	12	x	2.6	=	62.4	=	63	+	32	+	X T
5 May 21-May 30	2	x	12	x	4.4	=	105.6	=	106	+	53	+	X T
6 May 31-June 9	2	x	12	x	4.3	=	103.2	=	104	+	52	+	X
7 June 10-June 19	2	x	12	x	4.1	=	98.4	=	X	+	99	+	X
8 Sept. 1-Sept. 15	2	x	10	x	7.5/11	=	185	=	75	+	X	+	110
9 Sept. 16-Sept. 30	2	x	10	x	3.7/11	=	167	=	57	+	X	+	110
10 Oct. 1-Oct. 15	2	x	10	x	4.4/10	=	154	=	44	+	X	+	100
11 Oct. 16-Oct. 30	2	x	10	x	5/9	=	140	=	50	+	X	+	90
12 Oct. 31-Nov. 14	2	x	10	x	1.2/7	=	82	=	12	+	X	+	70

Name Clyde Cashcropper

PROFITABLE COMBINATION OF CASH CROP ENTERPRISES

ALTERNATIVE CROP FIELD OPERATIONS TIME SCHEDULE

	TIME PERIODS												
	1	2	3	4	5	6	7		8	9	10	11	12
ALTERNATIVE CROP & FIELD OPERATION	4/1-4/20	4/21-4/30	5/1-5/10	5/11-5/20	5/21-5/30	5/31-6/9	6/10-6/19	6/20-8/31	9/1-9/15	9/16-9/30	10/1-10/15	10/16-10/30	10/31-11/14
	Hours Per Acre												
ALTERNATIVE CROP I: Hay 1													
Land Preparation		.13											
Planting													
Harvesting						.6		.6					
ALTERNATIVE CROP II: Hay 2													
Land Preparation		.13											
Planting													
Harvesting						.6		.6					
ALTERNATIVE CROP III: Wheat 1													
Land Preparation									.5				
Planting										.26			
Harvesting													

IV

Wheat 2

.5

.26

 Name Clyde Cashcropper

PROFITABLE COMBINATION OF CASH CROP ENTERPRISES

GRAIN STORAGE AND CORN DRYING WORKSHEET

What is your expected variable cost (¢/bu.) for drying corn down one point?

2¢ (2c)

.0175 gal. of L.P. x 40¢/gal. = $.007
.25 KW electricity x 5¢/KW = $.0125
$.0195
≈ 2¢

What percentage moisture do you dry corn that is to be stored on the farm?

an average 13 (res)

Will any of your corn be stored as high moisture grain? Yes or (No.)

If yes, how much? _____ bu. of dry corn

How much storage is available for dry corn and beans? (1,000 bu.) 40,000

Percent yield spring plowed land is of fall plowed land 90%

Name _____

PROFITABLE COMBINATION OF CASH CROP ENTERPRISES

FIXED ESPENSES AND MISCELLANEOUS INCOME

Fixed Expenses

Real Estate Taxes		_____
Depreciation		
Machinery & equipment	_____	
Building	_____	
Total		_____
Interest on Assets		
Interest paid	_____	
Farm net worth _____		
x Return on equity capital _____		
Interest on equity	_____	
Total		_____
Fixed labor expense		_____
Insurances		_____
Rental Expenses		
Cash land rent	_____	
Other _____	_____	
Total		_____

Miscellaneous Income (income not included in any enterprise budget)

Gas tax refunds	_____
Government payments	_____
Custom machine work	_____
Other _____	_____
Total	_____

WORKSHOP ON LABOR AND MACHINE AVAILABILITY

In this workshop total hours available for land preparation, planting and harvesting in each labor period are determined (page 23). The number of machine/men complements is multiplied by the number of hours worked per day to determine available hours per day. Based on the number of days available for field work the total hours available are divided among the above operations of land preparation, planting and harvesting. These calculations are recorded on the worksheet on page 23. See also Average Days Available for Field Work in Appendix B.

Also during this workshop variable grain drying costs and available storage space are calculated using the Grain Storage and Corn Drying Worksheet (page 27).

The worksheet on Fixed Expenses and Miscellaneous Income is easily completed using information from the participants records. This worksheet can be completed between sessions with time allocated for questions during the workshop. During the pilot school this discussion led to more questions on the differentiation between variable and fixed expenses. Again, the importance of variable expenses in planning of this type was explained.

CLYDE CASHCROPPER EXAMPLE

The example used for the school and classroom instruction at Cornell is Clyde Cashcropper. The partially completed budgets and forms here are from his farm. The output and adjusted analyses appear on pages 32-38.

Clyde farms 1000 acres in West Central New York. Half the farm is capable of growing 100 bu./acre corn and 30 bu./acre soybeans while the other half only has the potential for 85 bu./acre corn and 25 bu./acre soybeans. Clyde and his regional Cooperative Extension Specialist carefully fill out all of the needed information and submit it for analysis.

In analyzing the first analysis (or Base) Clyde notices a very high shadow price or value of additional planting capacity. By rebuilding his planter in the winter he hopes to increase his efficiency by reducing breakdowns. Also his wife, Carolyn, or son, Charles, can help him fill the planter with seed and fertilizer and keep it going during the lunch hour. After inputting the changes to increase corn acreage planted per hour he receives his first adjusted analysis. Notice here that his returns above variable cost have increased by $4710, the number of acres planted to corn have increased and the value of the scarce planting time has decreased. He feels that the $4710 is an excellent return for the changes he has made.

Clyde now decides that the optimum soybean yield he has selected for his Type I land is too low. It should be 33 bu./acre instead of 30 bu./acre.

This change shown in the third output increases returns above variable costs by $4357 over the first adjusted analysis. It also shifts the corn production entirely onto Type II land, moves some of the hay previously on Type I to Type II and widens the difference in shadow prices between Type I and Type II land.

With these changes Clyde now feels that he has a reasonable expectation of how to plan his crop enterprises in a normal year. He can use this as a starting point and use his own expertise to make day to day decisions during the cropping season.

THE SOLUTION PROCEDURE AND THE OUTPUT FORMAT

The first part of the third session is used to familiarize the participants with the solution procedure used to obtain the most profitable organization of farm alternatives and with the output format used in the program.

An introduction to linear programming is used in discussing the solution procedure. The simple case of two alternative activities and three restrictions is used to graphically illustrate the solution procedure. By using a series of overheads starting with the two alternatives and one restriction and ending with two alternatives and three restrictions with the price ratios, the basic idea of the solution procedure can be conveyed to most participants (Appendix E).

The second part of this teaching session is used to again discuss the meaning of the output.[1/] The discussion commences with the definition of management income. Since this concept was unfamiliar to most of the participants, additional discussion, including an example calculation procedure would have been useful. The meaning of the enterprise levels, price minus marginal costs and shadow prices, are then discussed.

The constraining factor (in terms of resources or rates of performance) in the computer program are owned acres or Type I land, rented acres or Type II land, land preparation capacity or time available, planting capacity or time available, harvesting capacity or time available, restrictions on amounts of alternate crops that can be planted, and other special restrictions (see pages 33-38). In the output under Value of Scarce Resources the shadow price of the above mentioned limiting factor is given. The shadow price listed is the amount by which return above variable costs would increase if one more unit of the constraining factor was available. It can also be interpreted as the decrease in net profit associated with a small decrease in factor availability. It can also give an indication of how much the farm manager could afford to pay for an additional unit of the constraining resource. This shadow price is valid for only small increases or decreases in available factors, for nothing is indicated in the computer solution about how much factor availability can be changed without the shadow price being changed as a consequence.

[1/] As will be explained in the next section, the farm managers are given the first analysis for their farm at this time.

BASE

◆ PROFITABILITY ◆

1. RETURNS ABOVE VAR COST = $ 124809. — total includes alternative crops
   VAR COST = $ 51976. — variable cost for all major crops

◆ CORN ACRES AND SALES ◆

2. ACRES OWNED LAND = 260.
   AVER BU/ACRE = 95.8
   TOTAL BUSHELS = 24895.
4. BU CORN SALES AT HARVEST = 0.
   BU CORN SALES AT SPRING = 24895.

◆ SOYBEAN ACRES AND SALES ◆

5. ACRES OWNED LAND = 67.
   AVER BU/ACRE = 28.2
   TOTAL BUSHELS = 1887.
6. ACRES RENTED LAND = 280.
   AVER BU/ACRE = 20.8
   TOTAL BUSHELS = 5811.
7. BU SOY SALES AT HARVEST = 0.
   BU SOY SALES AT SPRING = 7698.

◆ ALTERNATIVE CROP ACRES AND NET INCOMES ◆

CODE	TOTAL UNITS	OWNED UNITS	RENTED UNITS	TOTAL PROFIT
HAY 1	173.	173.	0.	$ 27976.
WHEAT 4	220.	0.	220.	$ 34122.

total profit for farm from each alternative crop

◆ CORN PLANT AND HARVEST SCHEDULE ◆

21. OWNED LAND SCHEDULE

ACRES PLANTED	ACRES HARVESTED SEP 01 - SEP 15	SEP 16 - SEP 30	OCT 01 - OCT 15	OCT 16 - OCT 30	OCT 31 - NOV 14
APR 21-APR 30	0.	0.	15.	14.	27.
MAY 01-MAY 10	0.	0.	0.	0.	108.
MAY 11-MAY 20	0.	0.	0.	0.	96.

108 acres of corn planted May 1-10 is harvested Oct. 31 - Nov. 14 on Type I or Owned Land

◆ SOYBEAN PLANT AND HARVEST SCHEDULE ◆

33. OWNED LAND SCHEDULE

ACRES PLANTED	ACRES HARVESTED SEP 01 - SEP 15	SEP 16 - SEP 30	OCT 01 - OCT 15	OCT 16 - OCT 30	OCT 31 - NOV 14
MAY 21-MAY 30	0.	0.	67.	0.	0.

39. RENTED LAND SCHEDULE

ACRES PLANTED	ACRES HARVESTED SEP 01 - SEP 15	SEP 16 - SEP 30	OCT 01 - OCT 15	OCT 16 - OCT 30	OCT 31 - NOV 14
MAY 21-MAY 30	0.	0.	60.	0.	0.
JUN 10-JUN 19	0.	0.	0.	220.	0.

BASE, continued

41. LAND PREPARATION SCHEDULE

OCT 16-OCT 30	260.
OCT 31-NOV 14	62.
MAY 01-MAY 10	108.
MAY 11-MAY 20	109.
MAY 21-MAY 30	334.

♦VALUE OF SCARCE RESOURCES ♦

50. OWNED LAND ($/AC) 66.70
RENTED LAND ($/AC) 57.52

an additional acre of Owned or Type I land would increase returns above variable costs by $66.70.

51. PREPARED LAND FOR PLANTING ($/AC)

53. HARVESTING CAPACITY ($/AC)

OCT 16-OCT 30	7.58
OCT 31-NOV 14	6.79

55. PREPARATION TIME ($/HR)

SEP 01-OCT 15	91.49
OCT 16-OCT 30	91.49
OCT 31-NOV 14	91.49
MAY 31-JUN 09	147.89

57. PLANTING TIME ($/HR)

APR 21-APR 30	139.38
MAY 01-MAY 10	160.17
MAY 11-MAY 20	114.36
MAY 21-MAY 30	71.95
MAY 31-JUN 09	38.40

One additional hour of planting time during May 1-10 is worth $160.17.

59. HARVEST TIME ($/HR)

SEP 01-SEP 15	195.16
OCT 16-OCT 30	19.40
OCT 31-NOV 14	22.41

70. ALTERNATE CROPS BREAK-EVEN PROFITS ($/AC)

CODE	OWNED	RENTED
1	161.40	0.0
3	164.28	0.0

78. COST OF SPECIAL RESTRICTIONS

CODE	COST

INCREASED CORN ACREAGE PLANTED PER HOUR

◆ PROFITABILITY ◆

1. RETURNS ABOVE VAR COST = $ 129519.
   VAR COST = $ 55758.

◆ CORN ACRES AND SALES ◆

2. ACRES OWNED LAND = 327.
   AVER BU/ACRE = 97.1
   TOTAL BUSHELS = 31706.
3. ACRES RENTED LAND = 37.
   AVER BU/ACRE = 79.0
   TOTAL BUSHELS = 2917.
4. BU CORN SALES AT HARVEST = 0.
   BU CORN SALES AT SPRING = 34623.

◆ SOYBEAN ACRES AND SALES ◆

6. ACRES RENTED LAND = 243.
   AVER BU/ACRE = 22.1
   TOTAL BUSHELS = 5377.
7. BU SOY SALES AT HARVEST = 0.
   BU SOY SALES AT SPRING = 5377.

◆ ALTERNATIVE CROP ACRES AND NET INCOMES ◆

	CODE	TOTAL UNITS	OWNED UNITS	RENTED UNITS	TOTAL PROFIT
HAY I	1	173.	173.	0.	$ 27976.
WHEAT II	4	220.	0.	220.	$ 34122.

◆ CORN PLANT AND HARVEST SCHEDULE ◆

21. OWNED LAND SCHEDULE

ACRES PLANTED	ACRES HARVESTED SEP 01 - SEP 15	SEP 16 - SEP 30	OCT 01 - OCT 15	OCT 16 - OCT 30	OCT 31 - NOV 14
APR 21-APR 30	0.	0.	0.	84.	0.
MAY 01-MAY 10	0.	0.	0.	49.	113.
MAY 11-MAY 20	0.	0.	0.	0.	81.

27. RENTED LAND SCHEDULE

ACRES PLANTED	ACRES HARVESTED SEP 01 - SEP 15	SEP 16 - SEP 30	OCT 01 - OCT 15	OCT 16 - OCT 30	OCT 31 - NOV 14
MAY 11-MAY 20	0.	0.	0.	0.	37.

◆ SOYBEAN PLANT AND HARVEST SCHEDULE ◆

39. RENTED LAND SCHEDULE

ACRES PLANTED	ACRES HARVESTED SEP 01 - SEP 15	SEP 16 - SEP 30	OCT 01 - OCT 15	OCT 16 - OCT 30	OCT 31 - NOV 14
MAY 11-MAY 20	0.	0.	14.	0.	0.
MAY 21-MAY 30	0.	0.	102.	26.	0.
JUN 10-JUN 19	0.	0.	0.	102.	0.

INCREASED CORN ACREAGE PLANTED PER HOUR, continued

41. LAND PREPARATION SCHEDULE

OCT 16-OCT 30	260.
OCT 31-NOV 14	62.
MAY 01-MAY 10	162.
MAY 11-MAY 20	132.
MAY 21-MAY 30	229.

◆VALUE OF SCARCE RESOURCES ◆

50. OWNED LAND ($/AC) 84.58
RENTED LAND ($/AC) 64.11

51. PREPARED LAND FOR PLANTING ($/AC)

53. HARVESTING CAPACITY ($/AC)

OCT 31-NOV 14	5.48

55. PREPARATION TIME ($/HR)

SEP 01-OCT 15	91.49
OCT 16-OCT 30	91.49
OCT 31-NOV 14	91.49
MAY 31-JUN 09	118.53

57. PLANTING TIME ($/HR)

APR 21-APR 30	133.18
MAY 01-MAY 10	143.80
MAY 11-MAY 20	76.20
MAY 21-MAY 30	53.34
MAY 31-JUN 09	38.10

59. HARVEST TIME ($/HR)

SEP 01-SEP 15	181.98
OCT 31-NOV 14	18.08

70. ALTERNATE CROPS BREAK-EVEN PROFITS ($/AC)

CODE	OWNED	RENTED
1	161.40	0.0
3	175.57	0.0

78. COST OF SPECIAL RESTRICTIONS

CODE	COST

INCREASED SOYBEAN YIELD ON TYPE 1 LAND

◆ PROFITABILITY ◆

1. RETURNS ABOVE VAR COST = $ 133876.
   VAR COST = $ 53521.

◆ CORN ACRES AND SALES ◆

3. ACRES RENTED LAND = 244.
   AVER BU/ACRE = 82.6
   TOTAL BUSHELS = 20190.
4. BU CORN SALES AT HARVEST = 0.
   BU CORN SALES AT SPRING = 20190.

◆ SOYBEAN ACRES AND SALES ◆

5. ACRES OWNED LAND = 356.
   AVER BU/ACRE = 31.3
   TOTAL BUSHELS = 11136.

◆ ALTERNATIVE CROP ACRES AND NET INCOMES ◆

	CODE	TOTAL UNITS	OWNED UNITS	RENTED UNITS	TOTAL PROFIT
HAY I	1	144.	144.	0.	$ 23200.
HAY II	2	36.	0.	36.	$ 4347.
WHEAT II	4	220.	0.	220.	$ 34122.

◆ CORN PLANT AND HARVEST SCHEDULE ◆

27. RENTED LAND SCHEDULE

		ACRES HARVESTED				
ACRES PLANTED	SEP 01 SEP 15	SEP 16 SEP 30	OCT 01 OCT 15	OCT 16 OCT 30	OCT 31 NOV 14
APR 21-APR 30	0.	0.	0.	13.	69.
MAY 01-MAY 10	0.	0.	0.	0.	162.

◆ SOYBEAN PLANT AND HARVEST SCHEDULE ◆

33. OWNED LAND SCHEDULE

		ACRES HARVESTED				
ACRES PLANTED	SEP 01 SEP 15	SEP 16 SEP 30	OCT 01 OCT 15	OCT 16 OCT 30	OCT 31 NOV 14
MAY 11-MAY 20	0.	0.	77.	0.	0.
MAY 21-MAY 30	0.	0.	127.	0.	0.
JUN 10-JUN 19	0.	0.	0.	152.	0.

INCREASED SOYBEAN YIELD ON TYPE 1 LAND, continued

41. LAND PREPARATION SCHEDULE

OCT 16-OCT 30	260.
OCT 31-NOV 14	62.
MAY 01-MAY 10	162.
MAY 11-MAY 20	77.
MAY 21-MAY 30	279.

◆VALUE OF SCARCE RESOURCES ◆

50. OWNED LAND ($/AC) 95.40
RENTED LAND ($/AC) 66.43

51. PREPARED LAND FOR PLANTING ($/AC)

53. HARVESTING CAPACITY ($/AC)

OCT 31-NOV 14	0.77

55. PREPARATION TIME ($/HR)

SEP 01-OCT 15	96.80
OCT 16-OCT 30	96.80
OCT 31-NOV 14	96.80
MAY 31-JUN 09	100.27

57. PLANTING TIME ($/HR)

APR 21-APR 30	136.50
MAY 01-MAY 10	163.00
MAY 11-MAY 20	107.52
MAY 21-MAY 30	75.26
MAY 31-JUN 09	53.76

59. HARVEST TIME ($/HR)

SEP 01-SEP 15	177.35
OCT 31-NOV 14	2.55

70. ALTERNATE CROPS BREAK-EVEN PROFITS ($/AC)

CODE	OWNED	RENTED
1	161.40	0.0
3	184.07	0.0

78. COST OF SPECIAL RESTRICTIONS

CODE	COST

The shadow prices presented in the value of scarce resources section of the output can indicate the most limiting factor. It gives a basis for steps to take in improving the expected returns above variable costs for the farm. Comparisons of the value per hour in various time periods for land preparation, planting time and harvest time will indicate what period in which larger capacity machines, more machines and additional labor or more time in field during good days would be most profitable. Similarly, indications can be found by comparing value per acre of field capacities in land preparation, planting and harvesting. This may help a farm manager determine the value of custom hiring some operations performed. The opportunity cost of restrictions on the acres of crops or other special restrictions is also indicated in the output. If land has high values and there are few scarce field times, then additional land might be considered.

Factors that are not scarce have a shadow price of zero. If the supply of the factor is not completely used up, it does not improve profits if more of that input is made available. The output list omits those factors that are not scarce.

These prices or valuations are valid only if everything else is constant. Thus, if the availability of the scarce land resource is increased, then the shadow prices of that resource and also of other resources are likely to change. This means you must be cautious in taking action based upon the values of the scarce resources presented in the output.

SUGGESTIONS FOR A SUCCESSFUL SEQUENTIAL SCHOOL

At the end of the second session, the information needed for the first analysis has been collected on the worksheets discussed in the preceding sections. As these worksheets are collected, they should be scrutinized to be certain they are as complete and correct as possible. Each participant should be asked to include his phone number and a good time to reach him in case major problems arise.

In the pilot school, the completed worksheet sets were taken back to Ithaca, the information on the worksheets entered on the input form, and the first analysis run. This procedure assured each participant of a first analysis for his farming operation and resulted in the input being stored in the computer ready for retrieval for adjusted analyses.

After the first analysis is returned and the output is discussed in the third session, each participant is given time to study the first analysis for his farm. The participant and one or more of the specialists then discuss any questions concerning the first analysis and outline two or three ideas for adjusted analyses. It is important to spend sufficient time to be certain that each participant understands the information contained in his first analysis. It is also crucial that the changes to be considered in the adjusted analyses be carefully examined.

In the pilot school, two thirty-character-per-second printing terminals were used to run the adjusted analyses. The adjusted analyses were run as participants completed specification of factors to change for comparison with the base analysis.

A final but very important part of the third session is a discussion of the output between individual participants and one or more specialists. During this discussion, the specialist(s) should be certain the participant(s) understand the output and discuss procedures for implementing alterations in the farm operation indicated by the output. Due to the nature of a pilot school with the agents not having the opportunity to fully understand the program, not enough time was spent on this aspect in the pilot school. More time including follow-up work in some instances should be spent in future sequential schools.

This section consists of several suggestions that can be useful in conducting a successful school:

1. It will be helpful to request that farm managers sign up (including fee payment) in advance of the first session. This will facilitate preparations for the school and improve the chances that worksheets for the first session will be completed.
2. It is important that the room arrangement facilitate the completing of worksheets. The best arrangement is to have tables in a U-shape. Tables are a must.
3. It is important that the farm managers feel free to ask questions and make comments. A good way to start with an informal atmosphere is to have each participant introduce himself or herself, briefly describe the operation, and discuss his or her expectations from the school.
4. Agent participation is crucial. The school will work best when agents with field crops, farm management and perhaps vegetable crop responsibilities work with faculty from Cornell throughout the sequential school. Agents should provide leadership in teaching, assist in completing worksheets, and work with participants in understanding and using the output.

APPENDIX A. FARMER EVALUATIONS

1. Sample Evaluation Form.
2. Compilation of Responses in Sequential School.

Evaluation
of
Profitable Combination of Cash Crop Enterprises Sequential School

Location _____

I. How many of the sessions did you attend? 1 /7 2 /7 3 /7

II. How well was the purpose and direction of the school presented?

Very well	Adequate	Poor
/7	/7	/7

III. Was the information required on the worksheets:

Too difficult to obtain	Obtainable	Not specific enough
/7	/7	/7

IV. As a result of this sequential school on enterprise analysis, have you:

(check any that apply)

/7 Improved your farm management skills

/7 Become more knowledgeable in determining costs and returns for crop enterprises on your farm

/7 Learned about enterprise combination principles

/7 Assessed the impact on farm profitability of restrictions; i.e. amount of labor, acres of land, etc.

/7 Wasted your time

V. What suggestions for improvements in the school would you make?

VI. What were the most interesting parts of the school?

VII. What part of the school was most confusing or in need of the most improvement?

VIII. How would you evaluate this sequential school in comparison to other extension sponsored activities?

IX. Would you recommend this school to your neighbors? Yes /_7 No /_7

Why or why not?

X. Other comments:

Thank you for your comments. They will be used to further improve the school.

EVALUATION OF PROFITABLE COMBINATION OF CASH CROP ENTERPRISES

SEQUENTIAL SCHOOL IN CANANDAIGUA, NEW YORK

FEBRUARY-MARCH, 1979

I. How many of the sessions did you attend?

1 - 0
2 - 0
3 - 7

II. How well was the purpose and direction of the school presented?

Very well - 4
Adequate - 3
Poor - 0

III. Was the information required on the worksheets:

Too difficult to obtain - 0 (1 no answer)
Obtainable - 6
Not specific enough - 0

IV. As a result of this sequential school on enterprise analysis, have you:

1 Improved your farm management skills.

5 Become more knowledgeable in determining costs and returns for crop enterprises on your farm

5 Learned about enterprise combination principles

5 Assessed the impact on farm profitability of restrictions, i.e. amount of labor, acres of land etc.

1 Wasted your time

V. What suggestions for improvements in the school would you make?

1. Be more specific ahead of time as to what records, inputs, are to be used in class.
2. None in the presentation. The possibility of having another school in a year from now might help because we might have more ideas of combinations of enterprises. 1 day or 2 for repeat.
3. Better explanation of determining inputs such as labor, yields, prices.

VI. What were the most interesting parts of the school?

1. All three days were interesting and beneficial--the computer printouts were probably the highlight but the other worksheets were all very necessary and showed me a need to keep more detailed records.
2. The whole school was very interesting.
3. Of course day three was the most fun.
4. The relationship of planting time and harvesting dates in $/acre lost if not done on time.

VII. What part of the school was most confusing or in need of the most improvement?

1. Unfamiliar terms, but there was adequate time for explanations.
2. Trade offs between land preparation and planting.
3. Weather data played a key role but good data was almost nonexistent.
4. Operations time schedules.
5. Not so much the school being confusing as trying to interpret yields and prices.

VIII. How would you evaluate this sequential school in comparison to other extension sponsored activities?

1. Excellent
2. It is the best one I have attended.
3. Better
4. Equal or better
5. Excellent

IX. Would you recommend this school to your neighbors?

Yes - 6 (1 no answer)
No - 0

Why or why not?

1. I think it can make you realize some costs that are involved in producing a crop but you have never really figured them in.
2. Computer technology will soon become necessary for the farm manager to remain competitive in the business world. You have done an excellent job of informing me of its possibilities and limitations.
3. Am sure that neighbors would benefit by program.
4. It points out the figures needed to keep track of the operations.
5. Makes you aware of records and the use of analysis.

X. Other comments:

1. This should be a continuing program.
2. I think that it should be explained to all possible future farmer students that good records are very very important to have and really make them realize how accurate they should be.
3. Already doing some evaluation. Computer could not come up with additional information.

APPENDIX B. TIME AVAILABLE AND TIMELINESS OF FIELD OPERATIONS

1. Average Days Available for Field Work
2. Corn Yield by Planting and Harvesting Periods (Corn Yield Matrix)
3. Corn Moisture by Planting and Harvest Periods (Corn Moisture Matrix)
4. Early Variety Dry Bean Yield by Planting and Harvesting Period (Early Dry Bean - Region 1)
5. Late Variety Dry Bean Yield by Planting and Harvesting Period (Late Dry Bean - Region 2)
6. Wheat Yield by Planting and Harvest Date
7. Wheat Moisture Content by Planting and Harvest Date
8. Soybean Yield by Planting and Harvesting Period (Soybean - Region 3)
9. Nutrient Composition of Hay Crop Forages by Date of First Cutting

FARM MACHINERY ECONOMICS

Time Available and Timeliness of Field Operations

Time available is determined by two factors: weather and labor. A restriction on the time available to perform field operations is the number of days in which weather permits that given operation. Labor availability, in terms of number of hours worked per day, and scheduling of operations also have an impact on the amount of work that can be accomplished and the size of the machine required.

It is not only important that field operations be completed, but also that they be performed at the proper time. In corn production, planting and harvesting dates are important determinants of yield and moisture content of the grain. Significant yield reductions occur if corn is planted beyond May 10 in Central New York. Similar relationships exist for dry bean, wheat and soybean production.

Timeliness is also important in hay crop production. The major impact is, however, on nutrient composition rather than yield. Crude protein content declines greatly if cutting is delayed beyond June 1.

Yield reductions and moisture content of grains and nutrient content of hay crops have far reaching implications for not only size of machinery required but combination of crops grown and profitability. By increasing the size of machinery, increased yields and/or improved quality may more than offset the increased cost. By growing crops with different optimal planting and harvesting dates, a manager may be able to reduce peak labor demands and/or size of machinery.

Average Days Available for Field Work[a/]

Time Period	Land Preparation	Harvest
April 1-April 20	4.1	
April 21-April 30	3.3	
May 1-May 10	3.6	
May 11-May 20	2.6	
May 21-May 30	4.4	
May 31-June 9	4.3	
June 10-June 19	4.1	
September 1-September 15	7.5	11
September 16-September 30	5.7	11
October 1-October 15	4.4	10
October 16-October 30	5.0	9
October 31-November 14	1.2	7

a/ Data was recorded at the Cornell University Research Farm, Aurora, New York from 1959 through 1976. Based on soil tractability.

CORN YIELD BY PLANTING AND HARVESTING PERIODS[a/]

Planting Date	Harvest Date: Sept. 1-Sept. 15	Sept. 16-Sept. 30	Oct. 1-Oct. 15	Oct. 16-Oct. 30	Oct. 31-Nov. 14
	Percent of Optimal Yields[b/]				
April 21-April 30	95	97	98	98	95
May 1-May 10	96	98	99	100	98
May 11-May 20	---	90	92	94	93
May 21-May 30	---	---	80	84	86
May 31-June 9	---	---	---	70	76
June 10-June 19	---	---	---	60	65

a/ Full season hybrid for Central and Western New York with approximately 2600 growing degree days. For earlier (approximately 2000 growing degree days) hybrids, relationships can be advanced one harvest period.

b/ Yield percentages include both response to planting date and harvest losses due to harvest moisture.

CORN MOISTURE BY PLANTING AND HARVESTING PERIODS

Planting Date	Harvest Date: Sept. 1-Sept. 15	Sept. 16-Sept. 30	Oct. 1-Oct. 15	Oct. 16-Oct. 30	Oct. 31-Nov. 14
	Percent				
April 21-April 30	35	30	27	24	20
May 1-May 10	38	33	29	25	20
May 11-May 20	N.M.	40	33	27	22
May 21-May 30	N.M.	N.M.	40	30	23
May 31-June 9	N.M.	N.M.	N.M.	30	24
June 10-June 19	N.M.	N.M.	N.M.	30	25

N.M. = Not Mature

EARLY VARIETY DRY BEAN YIELD BY PLANTING AND HARVESTING PERIOD

Planting Date	Harvest Date: Sept. 1-Sept. 15	Sept. 16-Sept. 30	Oct. 1-Oct. 15	Oct. 16-Oct. 30	Oct. 31-Nov. 14
	- - - - - Percent of Optimal Yield - - - - - -				
April 21-April 30	---	---	---	---	---
May 1-May 10	---	---	---	---	---
May 11-May 20	---	---	---	---	---
May 21-May 30	100	75	10	---	---
May 31-June 9	100	90	40	---	---
June 10-June 19	50	100	100	75	20

LATE VARIETY DRY BEAN YIELD BY PLANTING AND HARVESTING PERIOD DATE

Planting Date	Harvest Date: Sept. 1-Sept. 15	Sept. 16-Sept. 30	Oct. 1-Oct. 15	Oct. 16-Oct. 30	Oct. 31-Nov. 14
	- - - - - Percent of Optimal Yield - - - - - -				
April 21-April 30	---	---	---	---	---
May 1-May 10	---	---	---	---	---
May 11-May 20	---	---	---	---	---
May 21-May 30	90	90	50	10	---
May 31-June 9	---	100	90	50	---
June 10-June 19	---	75	95	50	10

WHEAT YIELD BY PLANTING AND HARVEST DATE[a/]

Planting Date	Harvest Date				
	July 1-10	July 10-20	July 20-Aug. 1	Aug. 1-10	Aug. 10-20
	- - - - - - Percent of Optimum Yield - - - - - -				
Sept. 1-10	94	94	94	90	85
Sept. 10-20	98	100	100	98	95
Sept. 20-Oct. 1	88	90	90	88	85
Oct. 1-10	78	80	80	80	75
Oct. 10-20	60	62	65	65	62
Oct. 20-Nov. 1	40	47	50	52	52

a/ For Central New York. For areas of Western New York with longer fall growing periods, the estimated yield potentials can be shifted back one planting period. For areas with shorter falls, such as higher elevations or Northern New York, the potentials should be moved up one period.

WHEAT MOISTURE CONTENT BY PLANTING AND HARVEST DATE

Planting Date	Harvest Date				
	July 1-10	July 10-20	July 20-Aug. 1	Aug. 1-10	Aug. 10-20
	- - - - - - - - - - Percent - - - - - - - - - -				
Sept. 1-10	18	13	12	12	12
Sept. 10-20	20	15	13	12	12
Sept. 20-Oct. 1	22	16	13	12	12
Oct. 1-10	25	18	14	12	12
Oct. 10-20	30	20	15	13	12
Oct. 20-Nov. 1	35	25	20	15	12

SOYBEAN YIELDS BY PLANTING AND HARVESTING PERIOD[a/]

Planting Date	Harvest Date: Sept. 1-Sept. 15	Sept. 16-Sept. 30	Oct. 1-Oct. 15	Oct. 16-Oct. 30	Oct. 31-Nov. 14
	- - - - - Percent of Optimal Yield - - - - - -				
April 21-April 30	---	---	---	---	---
May 1-May 10	---	---	96	93	90
May 11-May 20	---	---	100	98	94
May 21-May 30	---	---	94	94	91
May 31-June 9	---	---	---	90	87
June 10-June 19	---	---	---	80	78

a/ Assumes a Group II variety.

NUTRIENT COMPOSITION OF HAY CROP FORAGES
BY DATE OF FIRST CUTTING

Type of Forage	Cutting Date	Nutrient Composition: Crude Protein	TDN
		(%)	(%)
Legume Forage	June 1	21.5	63
	June 15	17.5	57
	July 15	9.6	44
Non-Legume Forage	June 1	16.5	63
	June 15	13.1	57
	July 15	6.8	44

APPENDIX C. FIELD CAPACITY

1. Field Capacity Formula
2. Farm Machinery Characteristics

FARM MACHINERY ECONOMICS

Field Capacity

The field capacity of a machine is a function of the machine capacity, field efficiency and operating speed.

Machine capacity is the width of the machine. For example, with a grain combine it is the width of the grain head, for a corn planter machine width is the number of rows times the row spacing.

Field efficiency is the percentage of the theoretical field work accomplished after deducting for losses resulting from failure to use the full width of the machines, turning and idle travel at the ends, clogging, filling and adjusting seed, fertilizer and spray materials, unloading harvested crops, machine adjustments and minor repairs, lubrication, and other minor interruptions. It excludes waiting for supplies, wagons or trucks, major breakdowns, and daily service activities. Field efficiency for a particular machine varies with the size and shape of the field, field obstructions, pattern of the field operation, crop yield, moisture, and crop conditions, and the size of the machine also influences the field efficiency. Efficiency is reduced as larger machines are used. For example, the efficiency of corn planters and corn tillage tools is reduced about one percent for each row added, discs about one percent for each 30 inches of added width, and moldboard plows about two percent per bottom added.

The speed of the implement is influenced by the size of power unit, effective speed of the implement, the draft of the implement, the physical characteristics of the land, and the dexterity of the operator. Generally, the effective speed of the implement determines the rate of travel.

The amount of work that a machine will accomplish can be computed by using the following formulas:

$$\text{Field capacity (Acres/hour)} = \frac{\text{width of machine (inches)} \times \text{speed (m.p.h.)} \times \text{field efficiency (decimal)}}{100}$$

$$\text{Field capacity (Acres/hour)} = \frac{\text{width (ft.)} \times \text{speed (m.p.h.)} \times \text{field efficiency (decimal)}}{8.25}$$

FARM MACHINERY CHARACTERISTICS

Machine	Estimated Life (hours)	Speed mph	Field Efficiency (%)
Moldboard or disc plow	2,500	3.5-6.0	70-90
Chisel plow	2,500	4.0-6.5	70-90
Subsoiler		3.0-5.0	70-90
Land plane	2,500	-----	---
Powered rotary tiller 3-4 inch increment of cut		1.0-5.0	70-90
Harrow, single disc	2,500	3.0-6.0	70-90
Harrow, tandem disc	2,500	3.0-6.0	70-90
Harrow, offset or heavy tandem disc	2,500	3.0-6.0	70-90
Harrow, spring tooth	2,500	3.0-6.0	70-90
Harrow, spike tooth	2,500	3.0-6.0	70-90
Cultipacker		4.5-7.5	70-90
Rotary hoe	2,500	5.0-10	70-85
Rod weeder	2,500	4.0-6.0	70-90
Field cultivator	2,500	3.0-8.0	70-90
Field cultivator - heavy clay	2,500	3.0-8.0	70-90
Row crop cultivator	2,500	3.0-6.0	70-90
Fertilizer spreader Pull type	1,200	3.0-5.0	60-75
Anhydrous ammonia applicator		3.0-5.0	60-75
Field sprayer		3.0-5.0	50-80
Manure spreader, beaters	2,500		
Manure spreader, chain flails	2,000		
Manure spreader, liquid	2,500		
Corn or soybean planter, drilling seed only	1,200	3.0-6.0	50-85
Corn or soybean planter with all attachments	1,200	3.0-6.0	50-85
No-till corn planter	1,200	3.0-5.0	50-75
Grain drill	1,000	2.5-6.0	65-85
Mower	2,500	5.0-7.0	75-85
Mower-conditioner (cutterbar)	2,000	4.0-6.0	60-85
Mower-conditioner (flail)	2,000	4.0-6.0	60-85
S.P. mower-conditioner	2,500	3.0-6.0	55-85
Rotary mower;horizontal blade	2,000	3.0-8.0	75-85
Conditioner only	2,500	5.0-7.0	75-85
Side Delivery Rake	2,500	4.0-5.0	70-85
Baler, pto	2,500	3-10 T/hr.	60-85
Hay cuber		3-5 T/hr.	60-85

Machine	Estimated Life (hours)	Speed mph	Field Efficiency (%)
Flail type forage harvester			
in green forage	2,000	5-10 T/hr.	50-75
Forage harvester (pull-type)	2,000	2-4.5	50-75
Green forage		2-4.5	50-75
Wilted forage		2-4.5	50-75
Dry hay		2-4.5	50-75
Corn silage		2-4.5	50-85
Recutter & wilted forage		2-4.5	50-75
S.P. forage harvester	2,000		
windrower, small grain		5-7	75-85
PTO combine, wheat	2,000	2-4	65-80
S.P. Combine	2,000	2-4	65-80
Corn head	2,000		
Corn Picker	2,000		
1-row trailed		2-4	60-80
2-row trailed		2-4	60-80
Beet Topper	2,000	2-3	60-80
Sugar beet harvester	2,500	3-5	60-80
Forage Blower	2,000		
wilted hay crop		20-30 T/hr.	
corn or grass silage		20-50 T/hr.	
Tractor, 2 wheel drive	12,000		
Tractor, 4 wheel drive	12,000		
Tractor, crawler	12,000		
Truck, farm	2,000		
Truck, pickup	2,000		
Front end loader	2,500		

APPENDIX D. COST OF USING MACHINERY

1. Costs to be Considered
2. Ownership Costs
3. Repair Costs

FARM MACHINERY ECONOMICS

Cost of Using Machinery

Costs of using new or used machinery can be categorized into two groups, ownership or fixed costs and operating or variable costs. Ownership costs include depreciation, interest, taxes, insurance and housing. Operating costs include fuel and lubrication, repairs and labor.

Depreciation is the decline in value over the life of the machine. For tax purposes depreciation can be computed by the straight line method, the sum of digits method or the declining balance method. Assuming a reasonable salvage value, which method of depreciation will give the greatest amount of depreciation over the life of the machine? Each method will give the same amount of depreciation for the life of the machine. Furthermore, if a farmer depreciates a machine to a very low salvage value and then trades for another machine, the new machine will have a lower cost to be depreciated over its life. However, the actual total depreciation can never be known until the machine is sold or traded. With recent price increases for new machinery, many used items sell for prices greater than their original purchase price.

Interest on investment is the annual interest charge on the undepreciated value of machinery. The interest rate used here is ten percent of the remaining value of machinery at the beginning of each year. Many farmers do not think of interest as a cost unless they borrow money to purchase a machine. Even though money is not borrowed, interest charges should be considered because funds could be invested elsewhere and earn an income.

Taxes are levied against personal property in some states. New York does not have a personal property tax.

Insurance must be included as a cost of operation. Liability coverage should be included because tractors and other machinery may be involved in accidents resulting in liability claims. There may also be losses as a result of fire or high winds. Generally farmers do not insure individual machines, but have a blanket policy. A common rate is $5 per $1000 valuation or 0.5 percent of the remaining value at the beginning of each year.

Housing is another cost of using machinery. Some machinery repair costs may be increased if machinery is not properly housed. Some reports indicate that housing may increase the life of the machine, which in turn may be reflected in the trade-in value. Housing costs are estimated at 1.5% of the beginning yearly value.

Fuel and lubrication costs depend on the nature of the job being performed, the size of the unit, and the type of fuel used. Averaged annual fuel consumption in gallons per hour, based on University of Nebraska tractor test data, was estimated as follows:

gasoline = 0.06 x maximum p.t.o.h.p.
diesel fuel = 0.0438 x maximum p.t.o.h.p.
L.P. gas = 0.072 x maximum p.t.o.h.p.

For individual operations the gas consumption may vary considerably from the average. For plowing the consumption may be increased by about one-third.

Costs of oil, lubricants, and oil filters approach about 15 percent of the fuel cost.

The costs of fuel, oil, and lubricants per hour are estimated as follows:

Gasoline and lubricants = 0.069 x maximum p.t.o.h.p. x fuel cost
Diesel fuel and lubricants = 0.0504 x maximum p.t.o.h.p. x fuel cost
L.P. gas and lubricants = 0.0828 x maximum p.t.o.h.p. x fuel cost

Repair costs are the cost of maintaining a machine due to wear or use and deterioration. Some repair (tires, batteries, spark plugs, etc.) are directly associated with the amount of use. Costs of other repairs increase as the machine becomes older with a fixed amount of use. From cost studies of machinery all over the United States, the American Society of Agricultural Engineers have developed estimates of machinery repair costs.

Table 1. ACCUMULATED TOTAL OWNERSHIP COST OF FARM MACHINERY AS A PERCENT OF MANUFACTURER'S LIST PRICE

Age	Two & Four Wheel Drive Tractors	Self Propelled Combines, Mower Conditioners, Wagon and Box	Pickup Truck, Chisel & Moldboard Plow, Corn Picker, Harrow, Sprayer, Manure Spreader	Baler, Forage Blower, Forage Harvester
Years				
1	37.0	42.0	46.0	49.0
2	49.0	55.0	58.0	60.0
3	60.0	67.0	68.0	70.0
4	70.0	77.0	78.0	79.0
5	80.0	86.0	86.0	87.0
6	89.0	94.0	94.0	94.0
7	99.0	101.0	100.0	100.0
8	104.0	106.0	106.0	106.0
9	111.0	113.0	112.0	110.0
10	117.0	117.0	116.0	114.0
11	123.0	122.0	120.0	118.0
12	128.0	125.0	124.0	121.0
13	133.0	129.0	126.0	124.0
14	137.0	132.0	129.0	127.0
15	141.0	134.0	132.0	129.0

Table 2. ACCUMULATED REPAIR COSTS AS A PERCENT OF THE MANUFACTURER'S LIST PRICE FOR FARM MACHINERY

Hours of Use	Tillage Tools, Rotary Hoe Cutterbar Mower Cultivator, Cultipacker	Fertilizer Equipment	4-Wheel Drive & Crawler Tractors Hours of Use	4-Wheel Drive & Crawler Tractors Repair Costs	2-Wheel Drive Tractors Repair Costs
	- - - - - - - - - - - - - - - Percent - - - - - - - - - - - - - - -				
50	.8	.5	---	---	---
125	4.0	3.0	500	.5	.5
250	8.0	7.0	1,000	1.0	3.0
500	20.0	36.0	2,000	7.0	8.0
750	34.0	62.0	3,000	12.0	15.0
1,000	48.0	94.0	4,000	18.0	23.0
1,250	65.0	130.0	5,000	26.0	32.0
1,500	82.0	-----	6,000	35.0	42.0
1,750	100.0	-----	7,000	45.0	54.0
2,000	120.0	-----	8,000	55.0	66.0
			9,000	65.0	78.0
			10,000	76.0	91.0

Table 2 (continued)

ACCUMULATED REPAIR COSTS AS A PERCENT OF THE MANUFACTURER'S LIST PRICE FOR FARM MACHINERY

Total Hours of Use	Self Propelled Combine, Self Propelled Forage Harvester, Front End Loader, Manure Spreader, Pickup Truck	P.T.O. Baler, Corn Picker, Forage Blower, Sprayer, Pull Type Forage Harvester	Corn Planter, Grain Drill Mower Conditioner Rake
	- - - - - - - - - - - - Percent - - - - - - - - - - - -		
50	.3	.1	.3
125	.5	.5	.8
250	4.0	3.0	4.0
500	8.0	8.0	10.0
750	15.0	14.0	28.0
1,000	23.0	22.0	38.0
1,250	32.0	30.0	52.0
1,500	40.0	39.0	67.0
1,750	50.0	48.0	83.0
2,000	60.0	58.0	100.0
2,250	70.0	69.0	--
2,500	83.0	80.0	--

FARM MACHINERY ECONOMICS

Cost of Using Machinery

A Worksheet

1. Acres/Hour = $\dfrac{\text{Width (Ins.)} \_\_\_\_ \times \text{speed (m.p.h.)} \_\_\_\_}{100} \times \text{field efficiency (decimal)} \_\_\_\_$ — 1. _____ Acres

2. Hours of use per year = acres covered _____ ÷ acres per hour (line 1) — 2. _____ Hours

3. Total hours of use = hours of use per year (line 2) x years of use — 3. _____ Hours

4. Total ownership costs for years of use [Table 1] — 4. _____ %

5. Total repair costs of use for _____ (line 3) hours [Table 2] — 5. _____ %

6. Total ownership and repair costs (line 4 plus line 5) — 6. _____ %

7. Annual ownership and repair costs (line 6 x Manufacturers List Price ÷ years of use) — 7. _____ $/Year

8. Hourly ownership and repair costs (line 7 ÷ hours of use) — 8. _____ $/Hour

9. Cost of fuel and lubricants per hour = p.t.o. x [.0690 for gasoline / .0504 for diesel / .0828 for L.P. gas] x Fuel price per gallon _____ — 9. _____ $/Hour

10. Labor cost per hour — 10. _____ $/Hour

11. Cost per hour of using accompanying machinery — 11. _____ $/Hour

12. Total cost per hour = (line 8 + 9 + 10 + 11) — 12. _____ $/Hour

13. Total cost per acre = line 12 + line 1 — 13. _____ $/Acre

CUSTOM RATE CHARGE

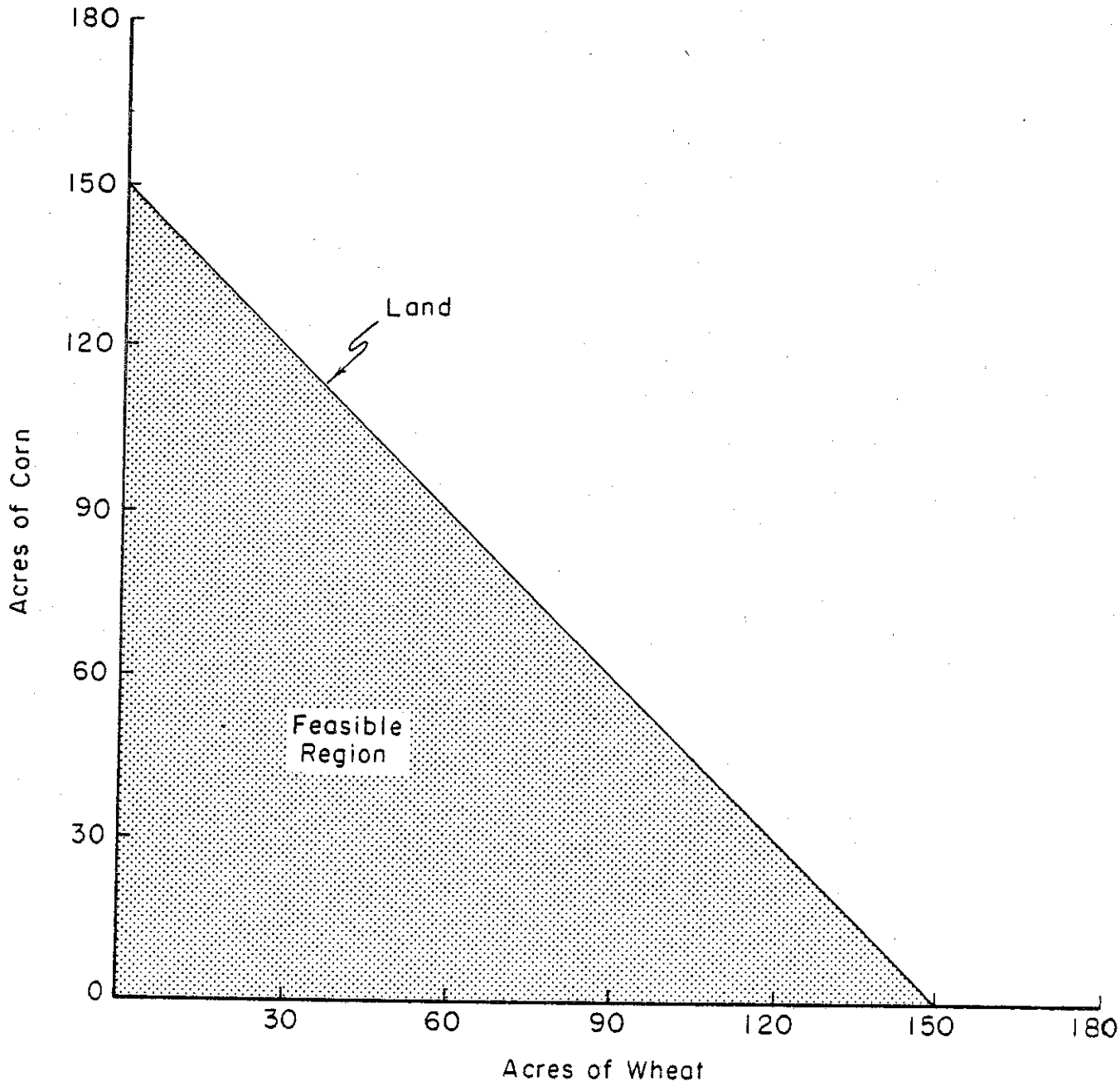
14. Adjustment for risk, time allowance for moving from job to job, other overhead and profit margin — 14. _____ $/Acre

15. Estimated custom rate (line 13 + line 14) — 15. _____ $/Acre

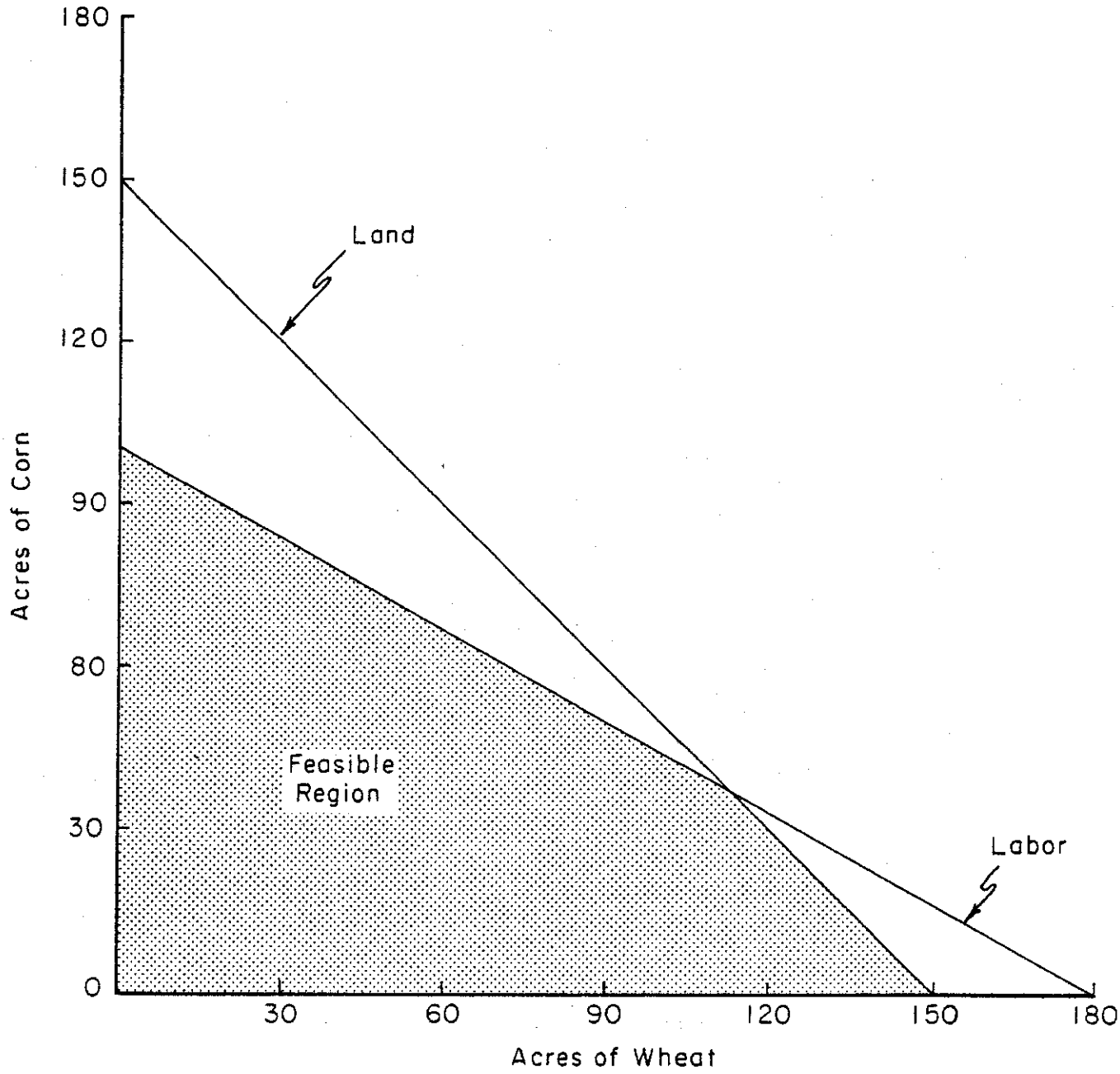
APPENDIX E. THREE INPUT-TWO OUTPUT LINEAR PROGRAMMING EXAMPLE

1. One Restriction - Land
2. Two Restrictions - Land and Labor
3. Three Restrictions - Land, Labor and Operating Capital
4. Three Restrictions Plus Returns Line
5. Three Restrictions Plus Change in Return Value of One Output

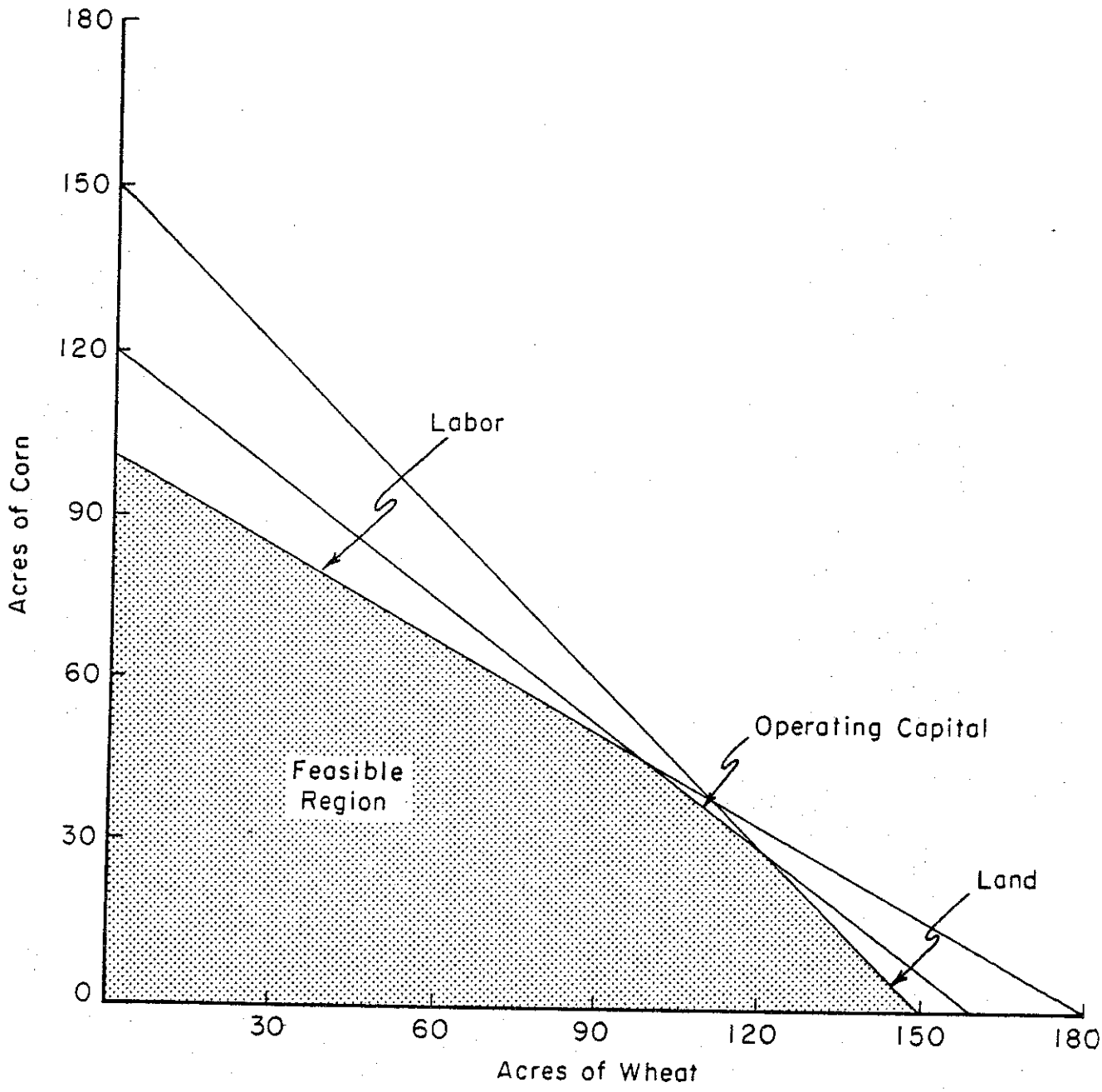
3 INPUT - 2 OUTPUT
LINEAR PROGRAMMING
EXAMPLE



Restrictions: 150 Acres of land

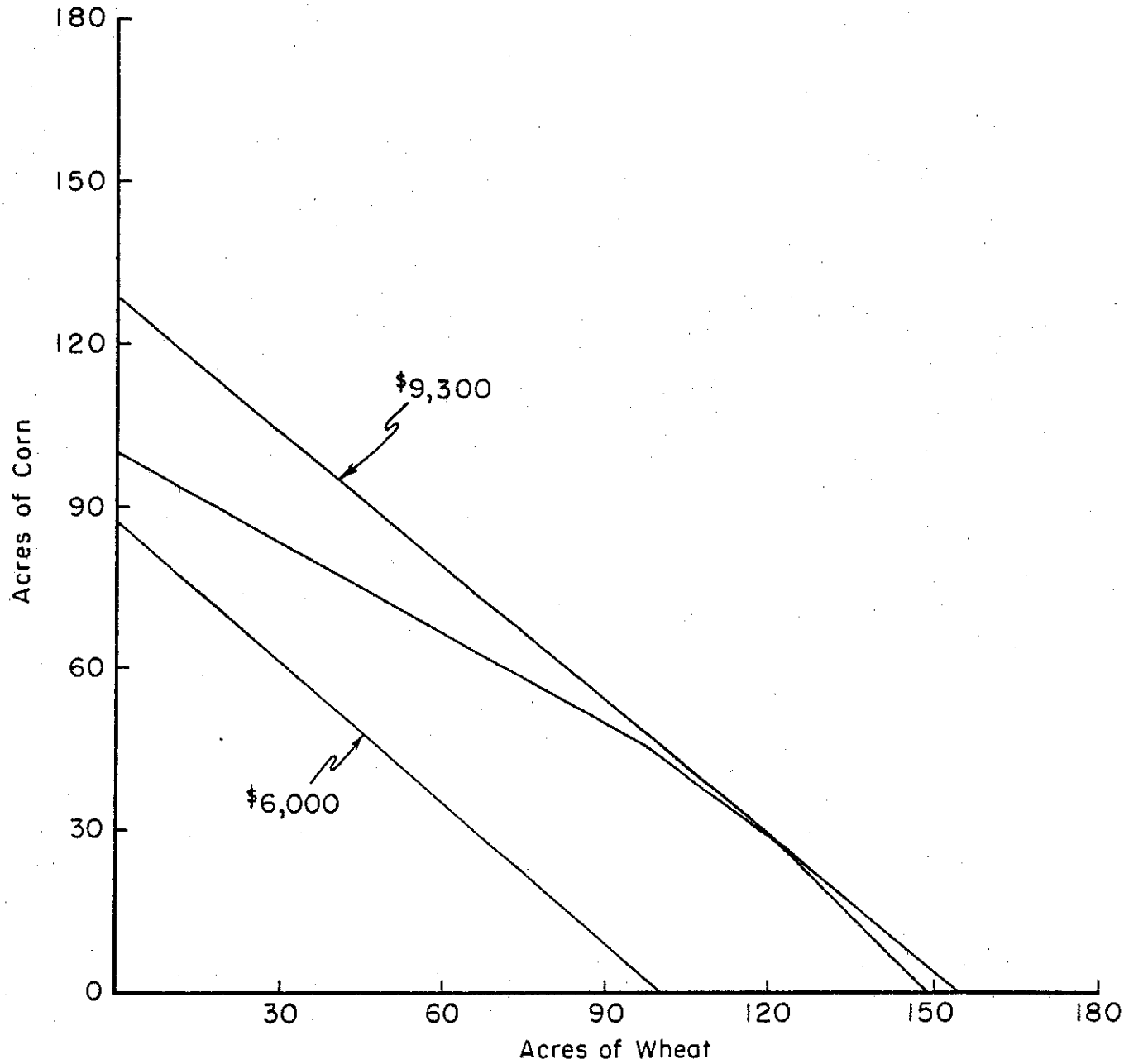


Restrictions: 150 Acres of land
600 Hours of labor, 6 Corn, 3.33 Wheat

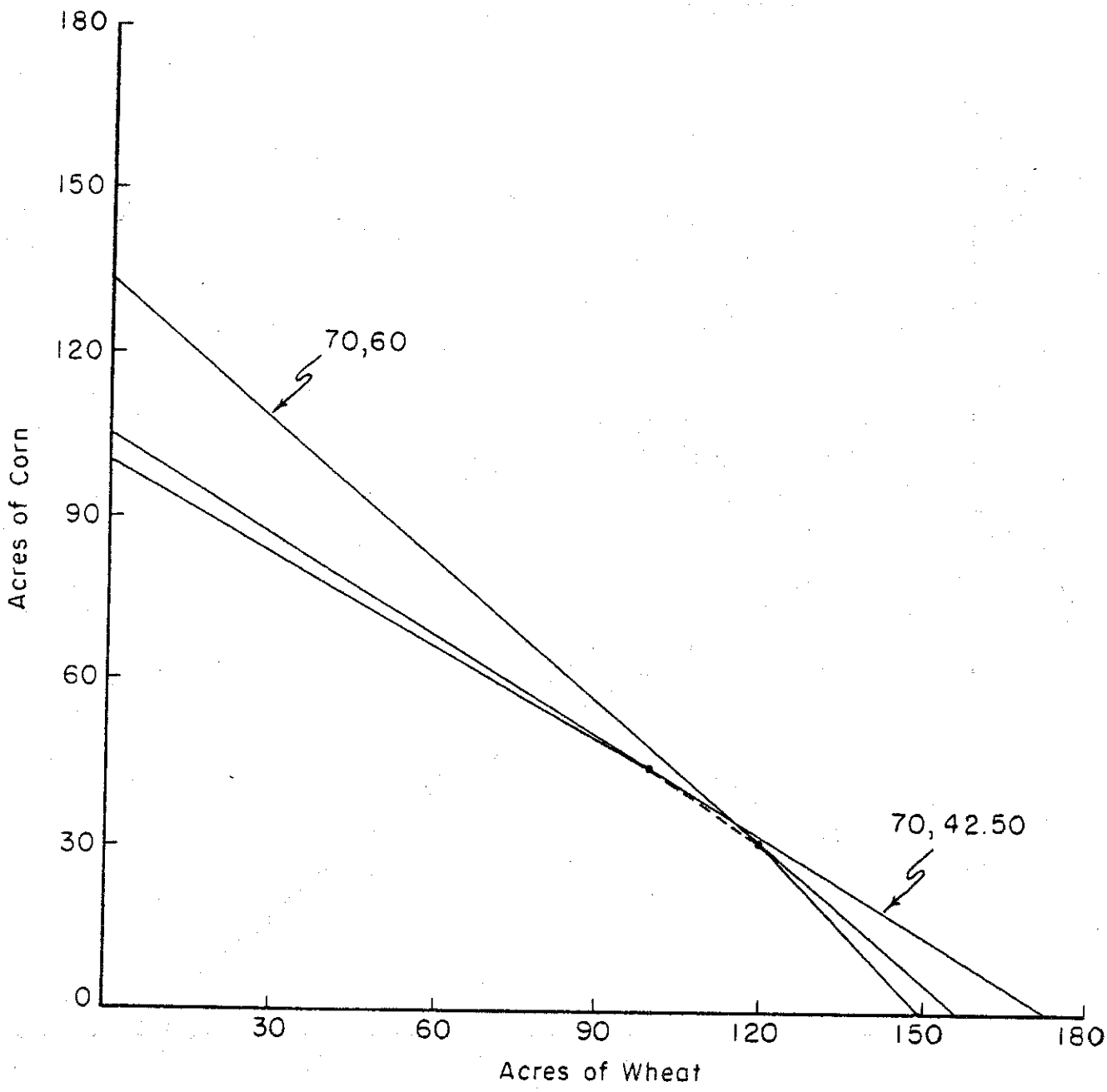


Restrictions: 150 Acres
600 Hours Labor
$14,400 Operating Capital
$120/A Corn, $90/A Wheat

RETURNS LINE WITH CORN $70/ACRE, WHEAT $60/ACRE



EFFECT OF CHANGE IN THE RETURNS OF WHEAT TO $42.50/ACRE



Net returns

$70/Acre Corn, $60/Acre Wheat

$70/Acre Corn, $42.50/Acre Wheat