
extension economics report

EER 227

OCTOBER 2006

PRODSYS : A Computer Application For Crop Production Planning Analysis

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1. Introduction

The selection of the most appropriate combination of inputs for crop production has never been an easy task for farm operators. A great amount of information is gathered throughout the year in order to make the best decision at the planting season. Consequently, farmers should pay serious attention to the quality of the information she or he gathered given that such a decision may affect all aspects of the farm operation including yields, land conservation, farm income, equipment deterioration, labor allegiance, cash flow, and family leisure time. Production planning is a powerful tool to prevent a farm business from financial hurdle.

In order to download PRODSYS, the user needs a computer with Internet capabilities and a web browser such as Netscape or Internet Explorer. For downloading this program, the user must check the following web address: <http://cherokee.agecon.clemson.edu/budgets/Budsys.htm>. The user can save or open the extension software application **ProdSys.xls** on to his or her computer. Microsoft Excel® and approximately one megabyte of available disk free space are required.

2. Planning Crop Production with PRODSYS

This program intends to give farm operators some insight on how to make use of four different crop production plans. To understand how to operate PRODSYS, the user needs to know first if there is more than one combination of chemicals and equipment that can be used for producing the desired crop. The farm production plans are A, B, C and D. See figure 1.



Figure 1. Main Menu

The program ProdSys.xls comes with four farm production plans to be used as illustration, only. The **CLEAR ALL** button is to be used to clear all the data previously entered in these four plans. In the main menu, it is also displayed the period that the input prices are valid. For example, if it is displayed the years of 2004/2005, the prices are current for 2004 and 2005, only. By using **PLAN A**, **PLAN B**, **PLAN C** or **PLAN D** buttons, you go straight to the farm production plan desired. The user can also choose to change some of the parameters, costs and rates that are used in various formulas for the calculation of variables and fixed costs on all the existing equipment by clicking on the **RATES** button. To finish, in order to compare all four plans, the user should click the button **ANALYSIS**. From there on, the user should be able to know which farm production practice is more economical. Chapter 3 will cover these charts.

a) RATES

The first step is to take a look at the rates and parameters to make sure that they depict current market conditions and sound production coefficients. See Figure 2.

	A	B	C	D	E	F	G
1	RATES AND COSTS THAT APPLY TO THE COSTS						
2	NAME				VALUE	ALL BLUE-COLORED DIGITS ARE SET TO BE CHANGED.	
3							
4	INTEREST RATE (%)				8.50		
5	INSURANCE RATE (\$/1000)				6.00		
6	TAX RATE (\$/1000)				0.00		FIND EQUIPMENT
7	DIESEL PRICE (\$/GALLON)				1.00		
8	GAS PRICE (\$/GALLON)				0.90		PLAN A
9	LP PRICE (\$/GALLON)				0.90		
10	LUBRICATION COST (%)				15.00		PLAN B
11	LABOR RATE (\$/HOUR)				6.00		
12	FUEL CONSUMPTION MULTIPLIER (DIESEL)				0.048		PLAN C
13	FUEL CONSUMPTION MULTIPLIER (GASOLINE)				0.068		
14	FUEL CONSUMPTION MULTIPLIER (LPG)				0.080		
15	MACHINERY LABOR MULTIPLIER				1.10		PLAN D
16	UNALLOCATED LABOR HOURS MULTIPLIER				1.25		
17							
18	MAIN MENU						
19							

Figure 2. Rates and Costs

Total fixed cost is the result of multiplying Total Fixed Cost Per Hour (depreciation + interest + insurance + tax) times Number of Hours Used. Thus, the default values for **INTEREST RATE (%)** of 8.5%, **INSURANCE RATE (%)** of \$6 per \$1,000 coverage, and **TAX RATE (%)** of \$0 per \$1,000 equipment value must be assessed by the user and changed if necessary. Total variable cost is the result of multiplying Total Variable Cost Per Hour (repair + fuel + lubricant costs) times Number of Hours Used. These costs refer to the use of the equipment for planting and harvesting seasons, and also the maintenance. Thus,

the default values for **DIESEL PRICE (\$/GALLON)** of \$1, **GAS PRICE (\$/GALLON)** of \$0.90, **LP PRICE (\$/GALLON)** of \$0.90, and **LUBRICATION COST (%)** of 15% of fuel cost per hour must also be assessed by the user and changed if necessary.

The **LABOR RATE (\$/HOUR)** is multiplied by allocated and unallocated hours to obtain total labor cost and should be assessed. The **MACHINERY LABOR MULTIPLIER** of 1.10 (additional 10% of machine hours) and the **UNALLOCATED LABOR HOURS MULTIPLIER** of 1.25 (additional 25% of total labor hours) are set by budgeting standards. The user might change if necessary. However, the three consumption multipliers must remain the same.

b) PLANS A TO D

The format used in this program is the same as the BUDSYS format. The first screen shows the PER ACRE MACHINERY AND LABOR REQUIREMENTS table. See Figure 3.

1	A	B	C	D	E	F	G	H	I	J
1	FARM PRODUCTION OPERATION - PLAN A									
2	PER ACRE MACHINERY AND LABOR REQUIREMENTS									
3	MONTH	OPERATION	TIMES OVER	LABOR HOURS	MACHINE HOURS	VARIABLE COSTS	FIXED COSTS	EQUIP NUM		
4		ALL BLUE-COLORED DIGITS ARE SET TO BE CHANGED.								
5										
6	2	GRAIN DRILL 16'	2.00	0.29	0.26	\$2.98	\$6.20	54		ENTER THE EQUIPMENT NUMBER OR TYPE "0"
7	3	SUBSOILER BEDDER 2-ROW	1.00	0.50	0.45	\$2.13	\$4.47	113		
8	5	DO-ALL FIELD CONDITIONER 8-ROW	1.00	0.10	0.09	\$1.16	\$1.72	46		FIND EQUIPMENT
9	5	CULTIVATOR 4-ROW	1.00	0.25	0.23	\$1.10	\$2.06	35		
10	9	COMBINE W/ HEADER	1.00	0.36	0.33	\$10.11	\$25.46	4		
11				0.00	0.00	\$0.00	\$0.00			PLAN B
12				0.00	0.00	\$0.00	\$0.00			
13				0.00	0.00	\$0.00	\$0.00			PLAN C
14				0.00	0.00	\$0.00	\$0.00			
15				0.00	0.00	\$0.00	\$0.00			PLAN D
16				0.00	0.00	\$0.00	\$0.00			
17				0.00	0.00	\$0.00	\$0.00			
18										
19	PER ACRE TOTALS FOR									
20	SELECTED OPERATIONS			1.50	1.36	\$17.48	\$39.91			ANALYSIS
21										
22	UNALLOCATED LABOR(HRS./AC.)			1.88						
23										
24	CHEMICAL									MAIN MENU
25										

Figure 3. Machinery and Labor Requirements

In column H, the user should enter the number of the equipment he or she is choosing to use for planting or harvesting. In column A, he or she should enter the month(s) of the year it is going to be used. In column C, the user should enter the number of times the equipment is to travel over the production area. To find the equipment number to be entered in column H, the user must click the **FIND EQUIPMENT** button. He or she must remember the production plan to go back to after the number is found. See Figure 4.

SELF-PROPELLED AND DRAWN IMPLEMENTS GENERAL SPECIFICATIONS														
PLAN A			PLAN B			PLAN C			PLAN D			RATES		
						[EXCLUDING TRACTOR]			[INCLUDING TRACTOR]					
NUM	MACHINE	ESTIMATED COST	TVC/ HOUR	TFC/ HOUR	TC/ HOUR	HRS/ AC	TVC/ AC	TFC/ AC	TC/ AC	TVC/ AC	TFC/ AC	TC/ AC		
SELF-PROPELLED ITEMS														
1.00	COMBINE	110583.73	26.15	65.86	92.01	0.33	-	-	-	8.63	21.73	30.36		
2.00	COMBINE LARGE	144912.62	34.27	86.30	120.57	0.25	-	-	-	8.57	21.58	30.15		
3.00	COMBINE LARGE VW HEADER	167397.87	39.59	99.69	139.28	0.25	-	-	-	9.90	24.92	34.82		
4.00	COMBINE VW HEADER	129558.17	30.64	77.16	107.80	0.33	-	-	-	10.11	25.46	35.57		
5.00	COTTON PICKER 2-ROW	121377.75	48.83	60.39	109.22	0.76	-	-	-	37.11	45.90	83.01		
6.00	COTTON PICKER 4-ROW	196424.73	79.02	-	-	-	-	-	-	30.03	37.13	67.16		
7.00	COTTON FINGER STRIPPER 4-ROW	115479.88	46.46	-	-	-	-	-	-	10.69	13.21	23.90		
8.00	HIBOY	70446.44	24.93	-	-	-	-	-	-	1.50	3.48	4.98		
9.00	TOBACCO COMBINE 1-ROW	57901.40	12.06	-	-	-	-	-	-	18.81	55.55	74.36		
10.00	TOBACCO COMBINE 2-ROW	78956.45	18.44	-	-	-	-	-	-	17.10	50.50	67.60		
11.00	TRACTOR 50-60 HP (1)	19927.16	3.87	-	-	-	-	-	-	-	-	-		
12.00	TRACTOR 70-80 HP (2)	25728.51	5.66	-	-	-	-	-	-	-	-	-		
13.00	TRACTOR 95-105 HP (3)	44970.49	8.49	9.70	18.19	-	-	-	-	-	-	-		
14.00	TRACTOR 115-125 HP (4)	55502.92	10.29	11.97	22.26	-	-	-	-	-	-	-		
15.00	TRACTOR 135-145 HP (5)	64833.67	12.01	13.98	25.99	-	-	-	-	-	-	-		
16.00	TRACTOR 155-165 HP (6)	76153.34	13.86	16.42	30.28	-	-	-	-	-	-	-		
17.00	TRACTOR 175-185 HP (7)	96438.52	16.30	20.80	37.10	-	-	-	-	-	-	-		
18.00	TRACTOR 195-205 HP (8)	107460.34	18.13	23.18	41.31	-	-	-	-	-	-	-		
19.00	VEGETABLE PICKER 4-ROW	147385.38	34.66	87.77	122.63	0.25	-	-	-	8.72	21.94	30.66		
20.00	VEGETABLE PICKER 1-ROW	25266.06	7.71	13.91	21.62	0.79	-	-	-	6.09	10.99	17.08		
DRAWN IMPLEMENTS														
21.00	4-BOTTOM FLIP PLOW	5016.37	3.96	3.10	7.06	0.25	0.99	0.78	1.77	1.96	2.07	4.03		
22.00	5-BOTTOM PLOW	7984.44	6.31	4.93	11.24	0.20	1.26	0.99	2.25	2.39	2.32	4.71		

Figure 4. Machinery General Specifications Table

In the SELF-PROPELLED AND DRAWN IMPLEMENTS GENERAL SPECIFICATIONS table, the equipment numbers are located in column A. The objective is to find the equipment desired via pressing **Ctrl+F** or clicking the scroll bar. Then, the user must return to the production plan by clicking the proper button (PLAN A, PLAN B, PLAN C or PLAN D) and type in the equipment number in column H of the PER ACRE MACHINERY AND LABOR REQUIREMENTS table. Then, click the **CHEMICAL** button. See Figure 5.

FARM PRODUCTION OPERATION - PLAN A									
CHEMICAL USE ASSUMPTIONS									
TYPE	NAME	UNIT	QUANT.	PRICE OR COST/UNIT	TOTAL PER ACRE	MONTH	CHEM NUM		
HERBICIDE	ROUNDUP ULTRA	QT	1.00	\$10.75	\$10.75	2X MAR/APR	127	ENTER THE CHEMICAL NUMBER OR TYPE "0"	
HERBICIDE	BICEP II MAGNUM	QT	1.50	\$10.38	\$15.56	MAR	23	FIND CHEMICAL	
				#N/A	\$0.00			PLAN B	
				#N/A	\$0.00			PLAN C	
				#N/A	\$0.00			PLAN D	
GROUP 1 // SUBTOTAL:					\$26.31			ANALYSIS	
INSECTICIDE	LORSBAN 15G	LB	7.00	\$1.65	\$11.55	MAR	88		
				#N/A	\$0.00				
				#N/A	\$0.00				
				#N/A	\$0.00				
GROUP 2 // SUBTOTAL:					\$11.55				
BACTERICIDE	MYCO-SHIELD	LB	1.00	\$22.50	\$22.50	APR	99		
				#N/A	\$0.00				
				#N/A	\$0.00				
				#N/A	\$0.00				
GROUP 3 // SUBTOTAL:					\$22.50				
TOTAL:					\$60.36				

Figure 5. Chemical Use Assumptions

In column AH, the user should enter the number of the chemical he is planning to apply during land preparation, pre-planting or planting. There are three distinct groups to divide them up. The user may choose to group herbicides, fungicides and insecticides separately for later chemical category analysis. In column AD, the user should enter the quantity to be applied per acre. In column AG, the user should enter the month(s) and total number of applications over the production area. To find the chemical number to be entered in column AH, the user must click the **FIND CHEMICAL** button. He or she must remember the production plan to go back to after the number is found. See Figure 6.

	A	B	C	D	E	F	G
1	FARM CHEMICAL COSTS, COMMON NAMES, AND UNITS						
2		PLAN A	PLAN B	PLAN C		PLAN D	ANALYSIS
3							
4	NUM	TYPE	PRODUCT NAME	UNIT	BUD GET	AVERAGE PRICE	COMMON NAME
5	1.0	HERBICIDE	2, 4-D	GAL	PT	15.15	2, 4-D
6	2.0	HERBICIDE	2, 4-DB 200	GAL	PT	22.98	2, 4-DB
7	3.0	HERBICIDE	AATREX 4L	GAL	QT	11.50	atrazine
8	4.0	FUNGICIDE	ABOUND FL	GAL	OZ	236.00	azoxystrobin
9	5.0	INSECTICIDE	ADMIRE	GAL	OZ	602.50	imidacloprid
10	6.0	BACTERICIDE	AG STREP (MYCIN)	LB	LB	18.99	streptomycin
11	7.0	INSECTICIDE	AGRIMEK	GAL	QT	646.00	abamectin
12	8.0	HERBICIDE	ALANAP	GAL	QT	37.50	naothalam
13	9.0	FUNGICIDE	ALLETTE	LB			
14	10.0	FUNGICIDE	ALLIETTE	LB			
15	11.0	INSECTICIDE	AMBUSH	GAL			
16	12.0	INSECTICIDE	AMMO	GAL			
17	13.0	INSECTICIDE	APOLLO	PT			
18	14.0	INSECTICIDE	ASANA XL	GAL			
19	15.0	FUNGICIDE	BANNER	GAL	PT	300.50	propiconazole
20	16.0	HERBICIDE	BANVEL	GAL	PT	85.00	dicamba
21	17.0	HERBICIDE	BASAGRAN	GAL	PT	81.00	bentazon
22	18.0	FUMIGANT	BASAMID	LB	LB	3.23	diazomet
23	19.0	HERBICIDE	BASIS GOLD	GAL	OZ	19.00	nicosulfuron+rimsulfuron+atrazine
24	20.0	FUNGICIDE	BAYLETON 50DF	LB	LB	72.00	triadimefon
25	21.0	INSECTICIDE	BAYTHROID	GAL	OZ	366.00	cyfluthrin
26	22.0	FUNGICIDE	BENLATE 50W	LB	LB	19.00	benomyl

Figure 6. Chemical Table

In the FARM CHEMICAL COSTS, COMMON NAMES, AND UNITS table, the chemical numbers are located in column A. The objective is to find the chemical desired via pressing **Ctrl+F** or clicking the scroll bar. Then, the user must return to the production plan by clicking the proper button (PLAN A, PLAN B, PLAN C or PLAN D) and type in the selected chemical number in column AH of the CHEMICAL USE ASSUMPTIONS table.

When the user is done with the first plan (PLAN A), then he or she can start planning the first alternative farm production plan (PLAN B). A complete comparative analysis will take place in the Analysis section when all four plans are submitted. However, at least two should be created.

3. Comparing Plans using Charts

To be more assertive on which farm production operation offers greater return to the farmer in terms of savings, it is fundamental that users look into these graphs for comparative analysis. The first graph depicts the production costs by category. The user should be able to conclude about the best production practice in terms of cost of production simply by comparing the height of the bars in the chart. The lowest bar in the chart corresponds to the least costly operation. Also, the plan associated with the best production practice along with its total cost per acre is displayed in row 2 on a green colored background. See graph 1 below:

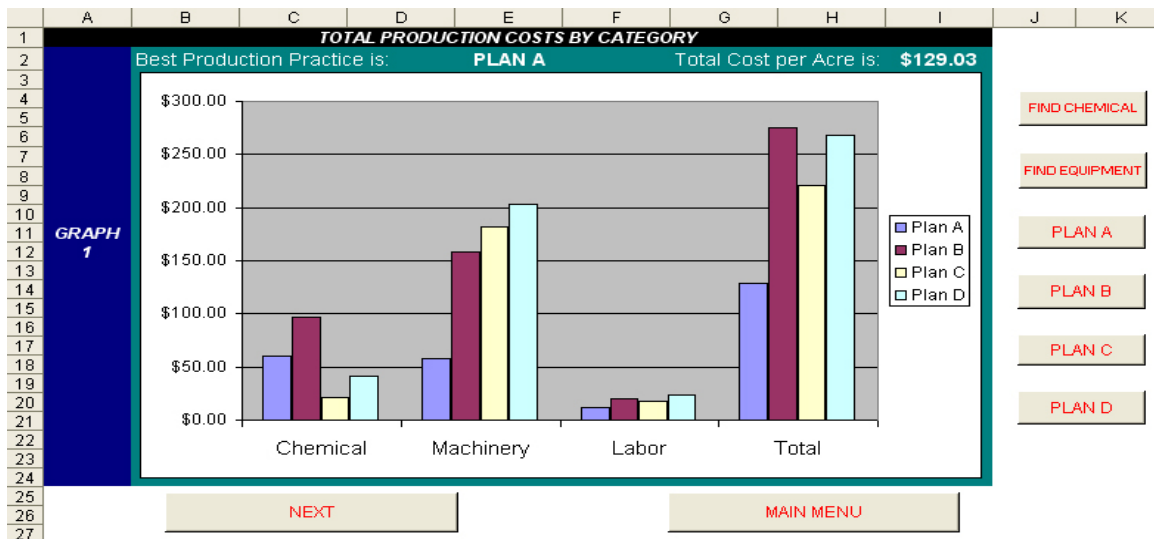


Figure 7. Graph 1 – Production Costs per Category

Interpreting this graph is a straightforward process. For this example, Plan A provides the most cost efficient operation among all four production plans. It is important to observe that Plan B has the least amount of money spent on chemicals. However, Plan A has been the least cost operation in terms of both machinery and labor activities.

By clicking the **Next** button, it will take the user to the second graph that depicts the cost incurred per category at each individual plan. Thus, it displays the percentage contribution of each category per plan. The user should be able to conclude that a more equitable distribution between costs on machinery and chemicals has given Plan A the comparative advantage in farm production (44% of all costs are machinery related expenses, 47% chemical and 9% labor). This implies that the choice between conservation and non-conservation practices has to be carefully estimated. See graph 2 below:

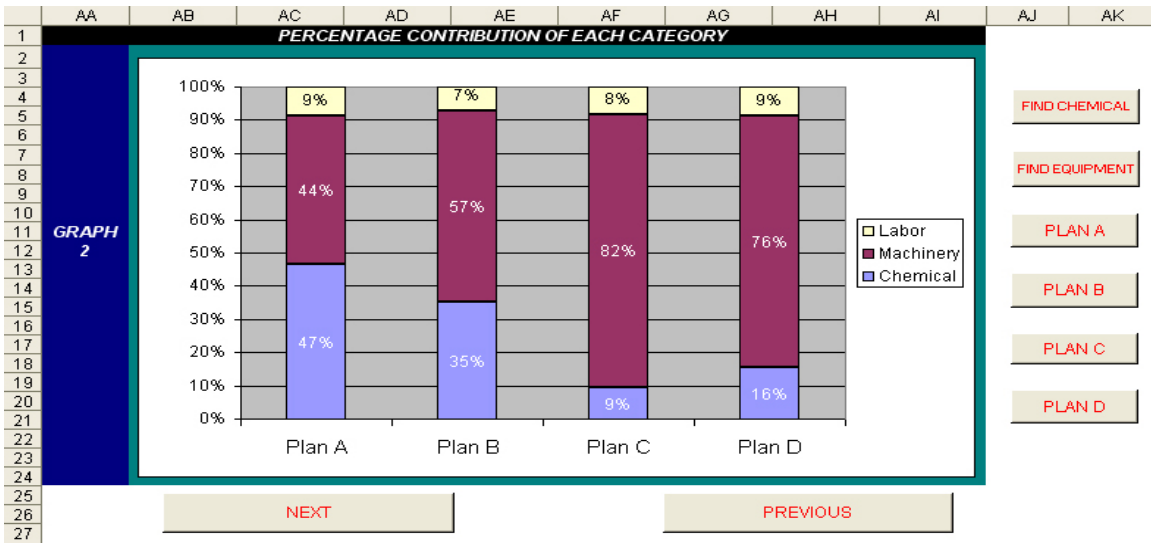


Figure 8. Graph 2 – Percentage Contribution of Each Category

By clicking the **Next** button, it will take the user to the third graph that depicts the chemical costs at each individual plan distributed by groups of chemicals. The user should be able to conclude that Plan B has incurred the highest level of expenses in herbicides (Group 1) among the four plans. Plan A has incurred the highest level of expenses in insecticides (Group 2), and the highest level of expenses in bactericides (Group 3) along with Plan B. This chart implies that the savings in chemical expenses can significantly reduce total costs and increase farm profitability. See graph 3 below:

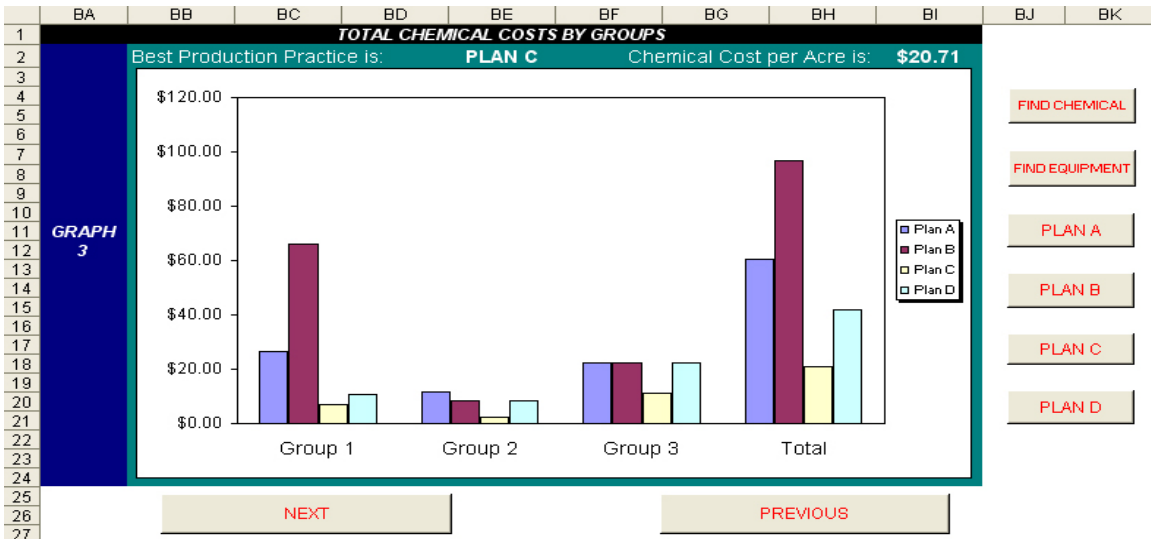


Figure 9. Graph 3 – Chemical Costs by Groups

By clicking the **Next** button, it will take the user to the fourth graph that depicts the percentage contribution of each group of chemicals at each individual plan. Once again, the user should be able to conclude that Plan B has incurred the highest level of expenses in herbicides (68% for Group1) among the four plans. However, even though Plan A has incurred the highest level of expenses

in insecticides (Group 2), it has almost the same percentage distribution as Plan D. Also, Plans C and D have the same distribution in bactericides (Group 3). This chart may possibly provide more evidences of savings that can be achieved in relative use of chemical groups across corresponding enterprises. See graph 4 below:

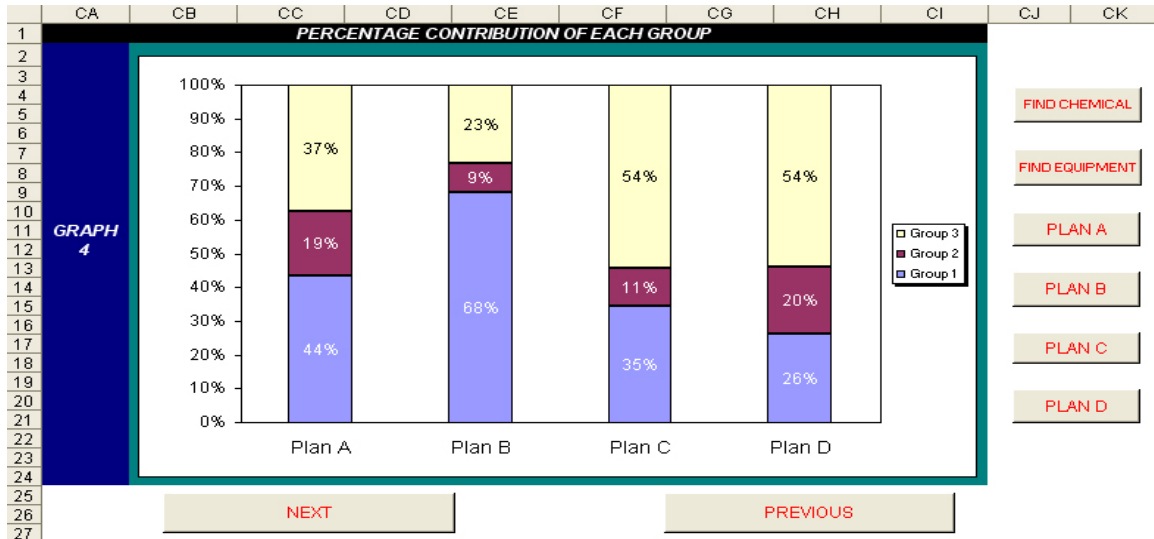


Figure 10. Graph 4 – Percentage Contribution of Each Chemical Group

By clicking the **Next** button, it will take the user to the fifth graph that depicts the machinery costs of each group of costs (fixed and variable) at each individual plan. Interpreting this graph is easy. For this example, Plan A provides the lowest machinery operation cost among all four production plans in both variable and fixed costs. See graph 5 below:

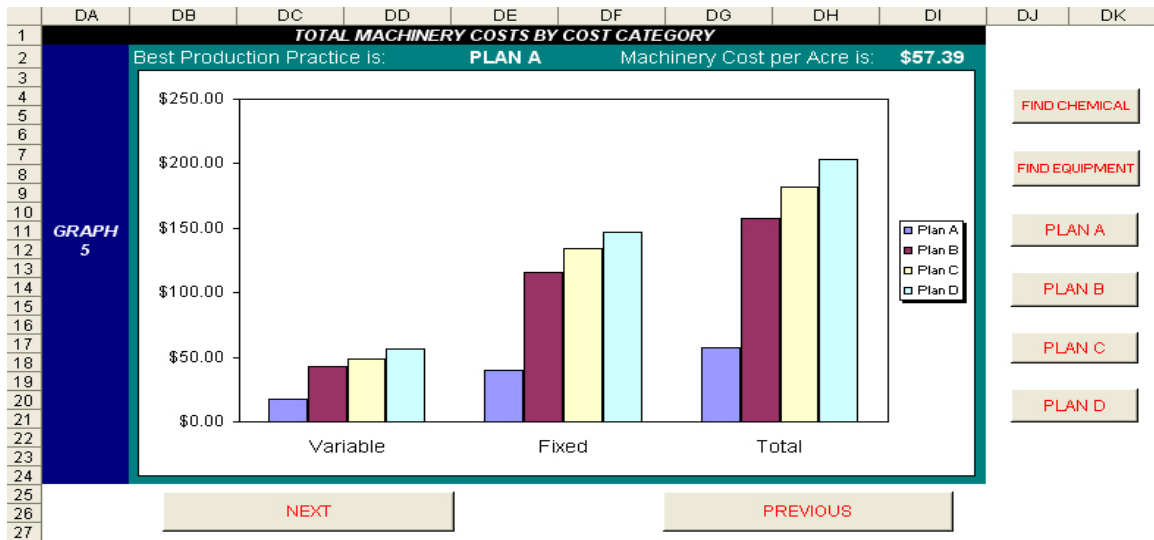


Figure 11. Graph 5 – Machinery Costs by Cost Category

By clicking the **Next** button, it will take the user to the sixth graph that depicts the percentage contribution of each machinery cost category per plan.

The user should be able to conclude that the percentage contribution of each plan depicted a similar distribution. That does not help explain why Plan A has the lowest machinery expenses. This implies that the choice between conservation and non-conservation practices has little effect on this comparative analysis. See graph 6 below:

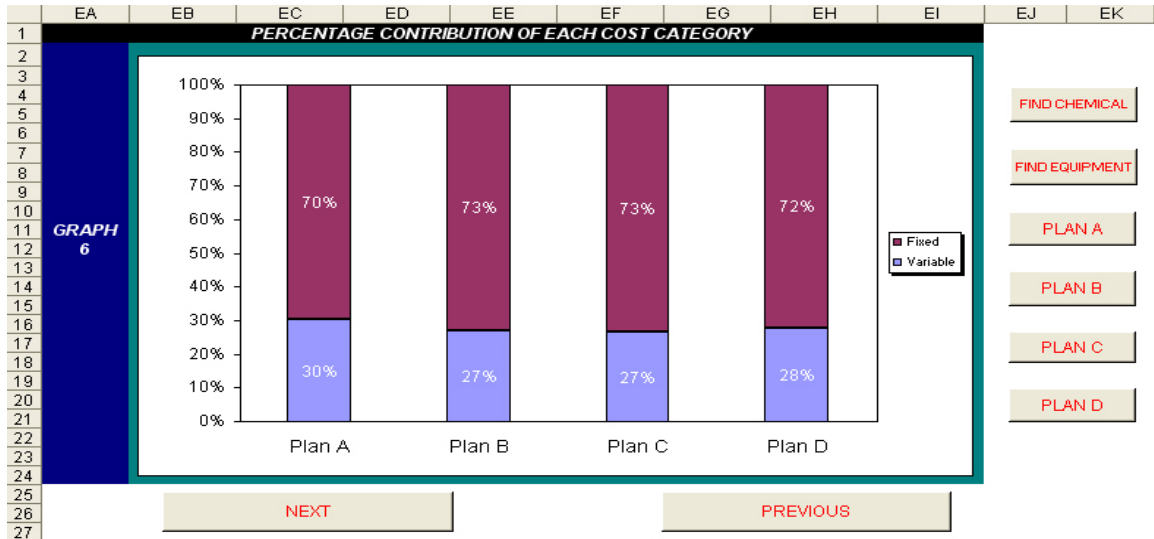


Figure 12. Graph 6 – Percentage Contribution of Each Machinery Cost Category

By clicking the **Next** button, it will take the user to the seventh graph that depicts the labor and machine hours by category (Machine, Labor and Unallocated Labor) at each individual plan. Interpreting this graph is also easy. For this example, Plan A provides the lowest machine and labor hours of operation among all four production plans. See graph 7 below:

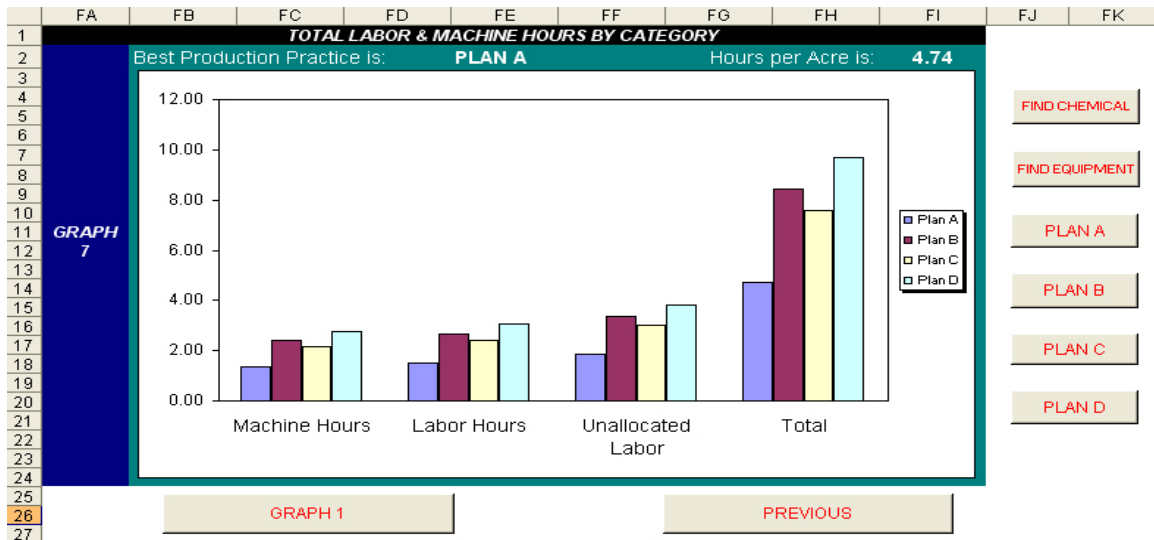


Figure 13. Graph 7 – Labor and Machine Hours by Category

It is not necessarily true that the same farm production plan will do well across all seven charts. When the production practices differ greatly, one plan

may show low labor costs whereas another plan may excel at low machinery costs as well as chemical costs. The interpretation of this discrepancy will help farm operators make better decisions as to reduce costs in areas that marginal costs are the most favorable.

4. Conclusion

This program should be used just as a complement to other managerial decision aid tools that have already been successfully used by the farm operator. Rates must be obtained from dependable sources in order to validate the outcomes generated by the graphical analysis. However, it is not recommended that decisions be made solely based on the information obtained from this program. Some of the assumptions made in the design of the program might not be consistent with the approach users usually adopt when making production or marketing decisions. This program has been designed for educational purposes only.

Farmers are strongly encouraged to carefully examine other production alternatives as to address farm operating costs (variable and fixed costs) that are capable of reducing expenses while increasing profits. It is also important that users take a look at the percentage contribution of those costs to better evaluate disproportionate costs associated with herbicide, insecticide and fungicide applications as well as machinery and labor deployment. Chemical and machinery prices are averages from a number of dealers across the state. It should not be used as an indicator of current market prices practiced by individual dealers. Clemson University Extension Service holds no responsibility for the use of the information contained in this computer program.