Software Users Guide 2

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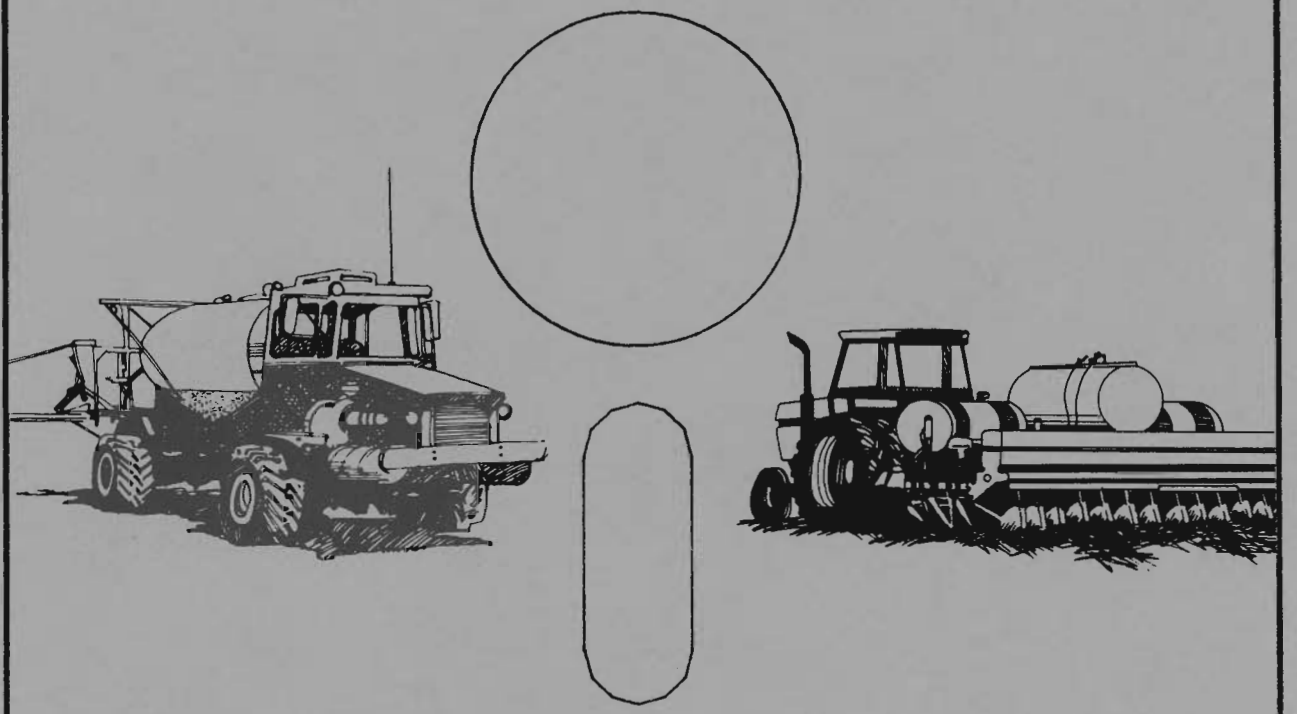
PHOSECON



Economics of Phosphorus Fertilizer Management

NDSU EXTENSION SERVICE
North Dakota State University, Fargo, ND 58105

PHOSECON

(Version 1.0)

by

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INTRODUCTION

Many soils in the northern Great Plains are deficient in plant-available phosphorus. Therefore, wheat and other grain crops often respond to the application of P_2O_5 fertilizer to a phosphorus deficient soil. Today's farm economic situation dictates that crop production inputs be carefully evaluated to assure maximum economic returns are achieved for the dollars invested. The software program PHOSECON was developed to help farmers, lenders, fertilizer dealers, Cooperative Extension Service personnel, and other agribusiness people evaluate the economic consequences of applying different amounts of fertilizer P_2O_5, either as a single broadcast application or as a combination of broadcast plus annual (band) applications, with or without the addition of nitrogen (N) fertilizer each crop year. This software program can be used to help make management decisions as to what method of application and rate of P_2O_5 should be used to achieve the greatest profit potential. This can be accomplished by the program user inputting different cost and price factors and P_2O_5 management strategies and then comparing the resulting output for each run of the program to observe changes in estimated profits.

PHOSECON was developed using crop yield and soil test data from a long-term soil fertility study conducted on a Williams loam soil, a dominant soil in western North Dakota, eastern Montana, and the northern Great Plains. The study was conducted from 1967 to 1983 near Culbertson in northeast Montana (Black, 1982; Halvorson and Black, 1985a, 1985b, 1985c). Halvorson et al. (1986) conducted an economic analysis of the data from this study which served as the basis for developing PHOSECON. PHOSECON, however, allows the user to change input costs, crop prices, money discount rates, and tax rates. PHOSECON also uses information from other sources, including the knowledge and experience of soil scientists, to simulate the effects on spring wheat yields of: (a) banding P_2O_5 fertilizer annually at a User specified rate following an initial broadcast P_2O_5 fertilizer application; (b) banding P_2O_5 fertilizer annually at a User specified rate without an initial broadcast application; and (c) annually banding a computer recommended rate of P_2O_5 fertilizer to achieve near maximum yield potential. Yield data from the long-term Culbertson study are used to calculate projected yields for each of the eleven crop years for the banding simulation. The efficiency of banding versus broadcasting P_2O_5 is taken into account and adjusted as a function of soil test P level similar to that reported by Peterson et al. (1981).

PHOSECON is presented in two parts which are indicated as "Part A" and "Part B" when the program is running. "Part A" evaluates the long-term economic consequences of applying a single, one-time application of P_2O_5 as influenced by the costs and prices input by the user while assuming crop yields and cropping sequences of the original database. "Part A" presents the following economic analysis of the database by presenting data tables showing:

1) The cumulative costs of the N and P_2O_5 fertilizer actually applied during the 17 years of the study.
2) Cumulative gross income minus the fertilizer cost (includes application costs).
3) Cumulative protein premiums for the wheat crops.
4) Cumulative gross income plus protein premium minus the fertilizer cost.
5) Discounted cumulative gross income minus fertilizer cost.
6) Discounted cumulative gross income plus protein premium minus fertilizer costs.

7) Discounted cumulative gross income plus protein premium minus fertilizer costs taxed at the specified tax rate.

"Part B" of PHOSECON simulates the effects of using both broadcast and/or annual band applications of P_2O_5 with or without the addition of 40 lb N/acre each crop year. "Part B" allows the user to select and input different P_2O_5 rates but not N rates, however, the N fertilizer costs can be changed. "Part B" allows the user to also extrapolate the database to other soils that may have a different soil test P level than the soil from the database. However, responses to P_2O_5 fertilization are limited to the yield difference between the check plot and that P_2O_5 treatment with the maximum yield each crop year, using the yield data from the long-term study. Cumulative yields and dollar returns above that of the check plot (no N or P_2O_5 fertilizer added) are presented for each of 11 crop years using the same cropping sequences simulated in "Part A". Output from "Part B" presents an estimated change in soil test P level as a function of P_2O_5 application each crop year for a loam soil. Phosphorus and N fertilizer can be applied by: a) either broadcasting or banding the P_2O_5 and N the first crop year with only a banding option available for applying N and P_2O_5 fertilizer for crop years 2 through 11 at P_2O_5 rates specified by the user; and b) banding P_2O_5 for optimum crop yield as determined by PHOSECON starting with either crop year 1 or 2.

In both "Part A" and "Part B", the first 6 crops (crops 1-6) simulate spring wheat grown in a wheat-fallow sequence and the last 5 crops (crops 7-11) simulate spring wheat grown annually without a fallow period between crops.

INSTRUCTIONS FOR USING PHOSECON

PHOSECON was developed to run on an IBM PC^2 or compatible computer using PC DOS or MS DOS operating systems, and having at least one 5 1/4" disk drive. This user's manual is intended to be used while running PHOSECON. Turn the computer ON by booting-up the system using a DOS diskette. Insert the "PHOSECON" diskette in drive A and type PHOSECON" and then press the RETURN or ENTER key. PHOSECON can be run on a hard disk drive system by copying the PHOSECON diskette to the hard disk drive. Note: To make a working copy of PHOSECON: Place your DOS disk in drive A and the PHOSECON disk in drive B and type SYS B: this will allow you to boot-up and run PHOSECON from the same diskette. NOTE: You must have the PHOSECON.EXE program and the ADDEDN, YIELD and PROTVALU data files on the floppy (or hard) disk in order to run the program.

PHOSECON will display the question: "Does your computer have RGB color/graphics capabilities (Y or N)." Input Y for yes or N for no. If your computer has RGB color/graphic capabilities, the program displays a logo used by the North Dakota State University Extension Service, otherwise the program proceeds directly to the introductory screen.

Screen 1: Present the NDSU Cooperative Extension logo. This screen is skipped if your computer does not have RGB color/graphics. Depress any key to continue.

Screen 2: Introductory screen that presents the model title, list of authors, and a disclaimer statement. Depress any key to continue.

Screen 3: Presents a brief description of Part A, the database, and assumptions used in the model. Depress any key to continue.

Screen 4: Presents a brief description of Part B and cautions the user about extrapolating the information to other soil types and climatic conditions. Depress any key to continue.

NOTE: By depressing and holding the Ctrl key down, then depressing the PrtSc key, the output from the program can be directed to both the screen and the printer. This can be done at any time throughout the program. To turn the output to the printer off, simply depress and hold the Ctrl key down then press the PrtSc key a second time. Another method of obtaining a hard copy of a given screen or monitor display is to depress and hold the Shift key down then press the PrtSc key. This option will give you a copy of only those screens you wish to have copied to the printer.

DESCRIPTION OF SCREENS FOR "PART A"

Screen 1: Displays the program default values for N, P_2O_5, and fertilizer application costs; grain price for wheat and protein premium; and discount rate (your cost of money above inflation rate) and tax bracket. These values can be changed by answering YES to the request to change prices. Any or all values can be changed. Enter only a two or three character response (no parentheses required).

Screen 2: Displays a table showing the cumulative N and P_2O_5 fertilizer cost, including application cost, from crop year 1 through 11. Remember, the P_2O_5 was applied only one time (crop year 1). Depress any key to continue.

Screen 3: Displays a table showing the cumulative change in gross income above check plot (no N or P_2O_5 added) minus the fertilizer cost from crop year 1 through 11 for each of the N and P_2O_5 treatments. Depress any key to continue.

Screen 4: Displays a table showing the cumulative value of the protein premium above that of the check plot from crop year 1 through 11. Depress any key to continue.

Screen 5: Displays a table showing the cumulative gross income above check plot minus fertilizer cost with the money discounted at the input discount rate from crop year 1 through 11. Depress any key to continue.

Screen 6: Displays a table showing the cumulative gross income plus protein premium above check plot minus fertilizer cost with the money discounted at the input discount rate from crop year 1 through 11. Depress any key to continue.

Screen 7: Displays a table showing the cumulative gross income plus protein premium above check plot minus fertilizer costs with the money discounted at the input rate and with tax debits and credits figured using the input tax rate. Depress any key to continue.

At this point in the program, the user can change the input values and rerun "Part A," branch to "Part B" of the program, or terminate the program by answering NO to both questions.

DESCRIPTION OF SCREENS FOR "PART B"

Screen 1: Presents a brief introduction to this section of the program. Note: The program assumes that a sodium bicarbonate extractable P level (Olsen Test) of 18 ppm (36 lb/acre) in the 0 to 6 inch soil depth is needed to achieve optimum yield potential (Halvorson, 1986). Therefore, the program estimates the amount of P_2O_5 that needs to be broadcast applied initially to bring the soil test to 18 ppm, similar to the procedure used by Halvorson and Kresge (1982). The user has the option of inputting more or less

P_2O_5 than recommended by the program.

Screen 2: Displays the program default prices for grain, N and P_2O_5, fertilizer application cost, and protein premium; the default values for the discount rate on money and the income tax rate; and the native sodium bicarbonate extractable P level of the soil that has never received any fertilizer P. The user has the option at this point of changing any of the values. Enter only a two or three character response without parenthesis.

The program then asks for the current soil test P level of the 0 to 6 inch soil depth in ppm (note: ppm P = [lb P/acre]/2). The user inputs the current soil test P value in ppm.

The program then displays the estimated amount of P_2O_5 needed to be broadcast and incorporated to raise the soil test level to 18 ppm the first crop year. The user inputs the amount of P_2O_5 to be applied broadcast the first year.

The program then asks the user to indicate the rate of P_2O_5 that will be applied each crop year by banding (either with or below the seed). Inputting a -1 at this point will cause the program (PHOSECON) to estimate for you the amount of P_2O_5 that will need to be banded each crop year to maintain a soil test level of about 18 ppm for optimum yield potential. The user should input the amount of P_2O_5 to be banded or a -1 to have the program recommend the rate of needed P_2O_5.

Screen 3: Displays the inputted native and current sodium bicarbonate extractable soil P levels. Also displayed are the amount of P_2O_5 applied each year, time lapse, crop year, change in soil test P level, cumulative fertilizer P_2O_5 applied, and change in soil test P level without P_2O_5 added from crop year 1 through 11. REMEMBER, crops 1-6 are spring wheat-fallow and crops 7-11 are annual spring wheat. Depress any key to continue.

Screen 4: Displays the cumulative effects of P_2O_5 fertilization, with no N fertilizer applied each crop year, above that of the check plot (no N or P_2O_5 added), on grain yield, fertilizer cost, gross income, protein premium, gross income minus fertilizer cost, gross income plus protein premium minus fertilizer cost, gross income plus protein premium minus fertilizer cost with money discounted at input discount rate, and gross income plus protein premium minus fertilizer cost with money discounted at input discount rate and tax credits and debits figured at input tax rate. Depress any key to continue.

Screen 5: Displays the cumulative effects of P_2O_5 fertilization, with 40 lb N/acre applied each crop year, above that of the check plot (no N or P_2O_5 added), on grain yield, fertilizer cost, gross income, protein premium, gross income minus fertilizer cost, gross income plus protein premium minus fertilizer cost, gross income plus protein premium minus fertilizer cost with money discounted at input discount rate, and gross income plus protein premium minus fertilizer cost with money discounted at input discount rate and tax credits and debits figured at input tax rate. Depress any key to continue.

At this point the user has the option of inputting new values and rerunning "Part B," branching back to "Part A," or ending the program. Answering NO to both questions will end the program.

If your computer has RGB color/graphics capabilities, the program will display a soil fertility time clock until the space bar is pushed which will bring up a final color graphics

screen thanking the user for running PHOSECON. Pushing the space bar again will bring the computer system back to the DOS prompt.

[2]Mention of trade names or manufacturer within the context of this article are used solely to provide specific information and does not constitute a guarantee or endorsement by the U.S. Department of Agriculture or North Dakota State University.

REFERENCES

1. Black, A.L. 1982. Long-term N-P fertilizer and climate influences on morphology and yield components of spring wheat. Agron. J. 74:651-657.

2. Halvorson, A.D. 1986. Soil test and P rate relationships to maximum yield: West. 8 p. In Proc. Maximum Wheat Yield Systems Workshop, March 6-7, 1986, Denver, CO. Potash and Phosphate Institute, Atlanta, GA.

3. Halvorson, A.D., and A.L. Black. 1985a. Long-term dryland crop responses to residual phosphorus fertilizer. Soil Sci. Soc. Am. J. 49:928-933.

4. Halvorson, A.D., and A.L. Black. 1985b. Fertilizer phosphorus recovery after seventeen years of dryland cropping. Soil Sci. Soc. Am. J. 49: 933-937.

5. Halvorson, A.D., and A.L. Black. 1985c. Safflower helps recover residual nitrogen fertilizer. Mont. AgResearch 2:19-22.

6. Halvorson, A.D., A.L. Black, D.L. Watt, and A.G. Leholm. 1986. Economics of a one-time phosphorus application in the northern Great Plains. Applied Agricultural Research 1(3):137-144.

7. Halvorson, A.D., and P.O. Kresge. 1982. FLEXCROP: A dryland cropping systems model. U.S. Dept. of Agric. Production Research Report No. 180.

8. Peterson, G.A., D.H. Sander, P.H. Grabouski, and M.L. Hooker. 1981. A new look at row and broadcast phosphate recommendations for winter wheat. Agron. J. 73:13-17.

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