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SELECTION OF OPTIMUM CROPPING PATTERN FOR MAXIMUM RETURN THROUGH COMPUTER PROGRAMMING

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ABSTRACT

Computer software based on different operations of production such as land preparation, tillage (P.T/Tractor) operation, sowing, transplanting, weeding, fertilizer application, threshing, cleaning etc. was developed for the selection of optimum cropping pattern for maximum return (SOCPMR). The program was designed in order to optimize the cropping pattern from different cropping patterns. A study had been under taken to address the issue of labour cost, material cost and cost of products and byproducts to individual cropping pattern. Optimum cropping pattern was considered with regard to cost of productions among the seven different patterns. Maximum profit was achieved from pattern no. six and that pattern was T.aman-Boro-BARIpea-2.

Keywords: Optimum cropping pattern, Maximum return through computer programming

INTRODUCTION

Agriculture Information Technology (AIT) is a high technology, which has developed quickly with the application of computers and information networks in recent years. It plays an important role in sharing and optimally utilizing agricultural resources, precisely organizing agricultural production, improving environment, effectively developing sustainable agriculture and changing traditional agriculture into modern agriculture. Agricultural production systems even with well-defined components are complex. Software should be developed for researching and analyzing the components of farm production in terms of their effects on farms' accounts. A computer program is very important for multiple cropping approaches.

The objective of the study was to develop a Computer Software to determine the optimum cropping pattern based on the production costs and returns from the crops and crop by-products.

REVIEW OF LITERATURE

Arriaza and Gomez-Limon (2003) conducted a study to compare the predictive performance of several mathematical programming models. They compared the models of optimum solutions with observed crop distributions after the reform of the EU common Agricultural policy of 1992 by using the cropping patterns, yields and crop gross margins of 18 farms over a period of 5 years. El-Awar and others (2001) studied the optimal cropping pattern of limited water supply for irrigation of several crops in the same area. A linear programming mathematical model was developed to determine optimum water allocation. The lowest net return was achieved with the current cropping pattern. Awal and Roy (1996) developed a computer program to select the proper levels of tractor power based on farm size, cropping patterns, soil properties and climatic conditions. It was found that the optimum level of tractor power had been varied with size of the farmland and cropping pattern.

Singh and Chandratne (1995) developed a decision support system (DSS) for the purpose of crop planning and equipment selection in crop production based on Srilanka farming using Foxpro 2.0 Software package. The program extracts information on the farming situation from three files

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containing general socioeconomic, crop and equipment data that can be modified to accommodate changes. Firstly, the DSS suggests the most profitable crop plan for the available resources specified by the user. Using the resulting crop plan as the input system feasible to the situation, the equipment required for all the farming activities were predicted. Raman and Paul (1992) developed a linear programming technique to measure crop water requirement and availability and it was demonstrated for obtaining the optimum cropping pattern in terms of maximum area and returns. Ghassan *et al.* (1986) developed a mixed integer-linear programming model for navy bean production system to select the optimum harvesting method and machinery system. The study also considered the effect of having two mixed cropping systems (navy bean-corn and navy bean-sugar beet) on machinery selection and profit. The model results indicated the upright navy bean variety. The present study makes a modest attempt to explore the impact of cropping patterns on farmers' income and employment.

METHODOLOGY

The aim of this work was to develop suitable software for selection of an optimum cropping pattern that gives maximum return for the farmer. The software was to process the input data and calculate the crop production costs and the gross and net returns. First of all the requirement of input data were identified and formulation of input and output data were made. Then a database of the input data was created for subsequent processing in the proposed software. The software was then designed and developed using Visual Basic.

SELECTION OF CROPPING PATTERNS

Bangladesh is divided into 30 Agro-ecological zones (AEZ) with 88 sub-zones (BBS, 2001). Hundreds of different cropping patterns depending on the agro-ecological zones are found in different areas of the country. In this research one year cropping pattern was considered. For the present study seven cropping patterns were selected. Each cropping pattern may include two or three crops per year and in general most of the farmers include rice in their cropping patterns. The following cropping patterns were used in this study.

CP_1 = Jute - T.aman - wheat
CP_2 = T.aman - Wheat - Fallow
CP_3 = T.aman-Boro-Fallow
CP_4 = Boro-T.aman-Mustard
CP_5 = T.aman-Soybean-Fallow
CP_6 = Boro-T.aman-Peas
CP_7 = Boro-T.aman-Seam

FORMULATION OF CROP PRODUCTION COST AND RETURN

CROP PRODUCTION COSTS

The production costs of each crop were estimated by summing up the cost of each of the following items.

1. Cost of human labour for all operations (CL)
2. Cost of draught animal power and PT/Tractor (CP)
3. Cost of seeds/seedlings (CS)
4. Cost of fertilizers (CF)
5. Cost of insecticides (CI)
6. Cost of irrigation (CW)

Production cost of each crop is given by

PCC = CL + CP + CS + CF + CI + CW

The total production cost of a selected cropping pattern (PCP) was determined by adding the production cost of each crop of the cropping pattern.

PCP = ∑ PCCi

OPERATIONS INVOLVED IN CROP PRODUCTION

Crop production requires several cultural operations for the effective growth of the crop. The operations are plowing, harrowing, laddering, raking, bund forming, puddling, seeding, transplanting, fertilizer application, weeding, irrigation, spraying pesticides, harvesting, threshing, cleaning, drying, etc.

GROSS RETURN OF CROP AND CROPPING PATTERN (GR)

The gross return of crop was calculated using the following formula,

Gross return of crop = [Yield of crop (kg/ha) x Value of crop (Tk/kg)] + [Yield of by-product (kg/ha) x Value of by-product (Tk/kg)]

GRC = (YC x VC) + (YB x VB)

The gross return of the cropping pattern is given by

Gross return of the cropping pattern = Summation of gross return of individual crop

GRP = ∑ GRCi

NET RETURN OF CROPPING PATTERN (NRP)

Net return of the cropping pattern = Gross return of the cropping pattern – Total Production cost of the cropping pattern

NRP = GRP – PCP = ∑ GRCi – ∑ PCCi

Cost and return analysis was done using the above equations, which are based on the equation of Dillon and Hardaker (1980).

$$\pi = P_y Y + P_b.B - \sum_{i=1}^{n} (P_i X_i) - TPC$$

Where,

π = Per hectare profit (net profit) of individual crops under each of the cropping pattern.

P_y = Per unit price of the product of the individual crops.

Y = Per hectare quantity of the product of the individual crops.

P_b = Per unit price of the by-product of the individual crops.

B = Per hectare quantity of the by-product of the individual crops.

P_i = Per unit price of the input used for the crops.

X_i = Per hectare quantity of the input used for the crops.

TPC = Per hectare total production cost involved in producing the crops under each of the pattern and i = 1, 2, 3 ..... n (number of inputs used for producing the crop).

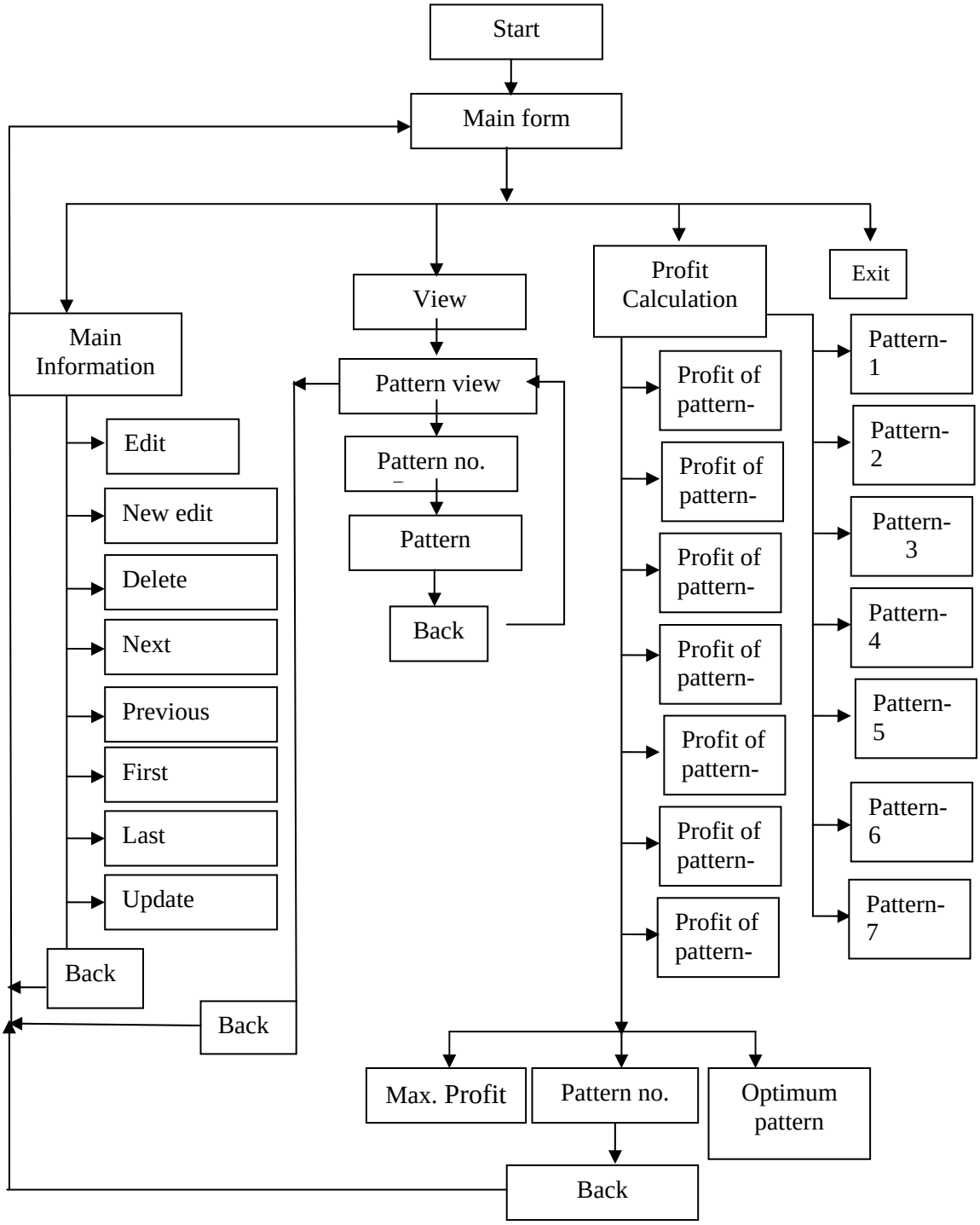

Figure 1. Flow diagram of the Software

RESULTS AND DISCUSSION

The application was designed and complied under windows environment. So, the resulting application would be a windows based program runs under windows 2000/XP and other compatible versions of Microsoft windows. The application was tested on a Pentium - 3 computer with 64 MB RAM. The application worked satisfactorily on that system. Any windows based software can execute the complied SOCPMR.

First the opening screen will appear (Fig. 2) when we use Visual Basic.

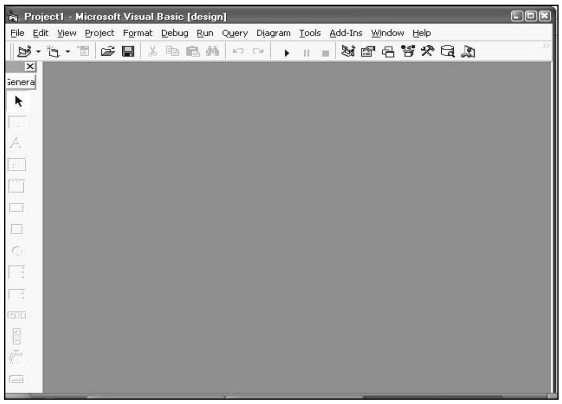

Figure 2. Opening Screen

Clicking on run button or press F_5 open the main menu form (Fig. 3). Then clicking on main information button shows the operation ID, pattern ID no., crop ID no., amount and rate (Fig. 4) on the display screen.

Clicking on view of the main menu form (Fig. 3), we can open the view pattern form (Fig. 5) then clicking on view pattern button shows the pattern number and drop down list. Selecting the pattern number from drop down list displays the cropping pattern in a box. After completion this operation clicking on back button reaches the main menu form.

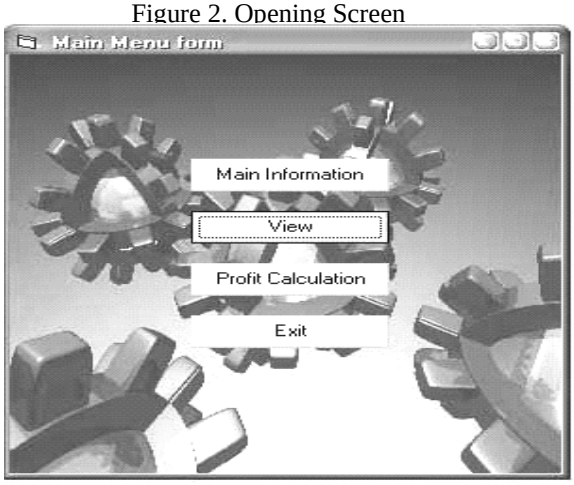

Figure 3. Main Menu form

Clicking on profit calculation button of the main menu form shows the operation ID, pattern ID no., crop ID no., amount and rate and other three boxes shows the total income, total expense and net profit of different patterns, respectively (Fig. 6).

Another 6 pattern can be obtained like this and finally the optimum profit calculation form will be as Fig. 7.

If availability of reliable information were ensured, the social and economic system of the country would function more efficiently. The application for selection of optimum cropping pattern for maximum return (SOCPMR) was complied and a file named "Main.VBP" was created.

ADVANTAGES OF SOCPMR

It has the higher storage facilities than the manual system. The speed of response of the system is very fast comparing the manual system. The system is user-friendly.

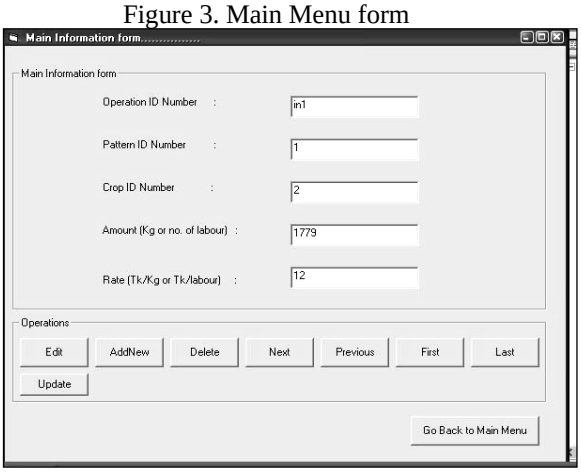

Figure 4. Main Information form

TESTING ACCURACY OF THE RESULTS

Manual calculation using calculator was made to verify the results given by the SOCPMR. The results were found 100% accurate.

SUMMARY AND CONCLUSION

Software was developed to determine the optimum cropping pattern for maximum return for both field operations and farmstead operations and total production cost analysis for seven selected crop patterns of this study were determined by a computer program written in Visual Basic language. Optimum cropping pattern of the seven cropping patterns with regard to cost of production can be calculated by using this program. A precise production cost analysis showed that the total cost of production varied for the different cropping patterns and per hectare net return was also varied. Maximum profit was achieved from pattern no. six and that pattern was T.aman-Boro-BARIpea-2.

APPLICATION AND VALIDITY OF THE SOFTWARE

The scope of application of the software is wide enough that can be used to plan, design different operation of production to farmers and analyzed system. The validity test was not possible of this program because the farm and farmers does not follow the proper cropping pattern but the authority of the farm put their view that the output of this program will result low machinery operation cost, less human labour and less material cost.

LIMITATIONS

The system is not provided with multi-level security system, all types of field wise query can not be done from the system except the main database.

RECOMMENDATIONS

The program can be modified so that it will run on several cropping patterns in a network environment to access the same data. Programming for shared access will be required then. Moreover, the developed system is flexible enough that can be extended to other operations by including intercultural operations, Bank loan, Land lease etc with slight modification.

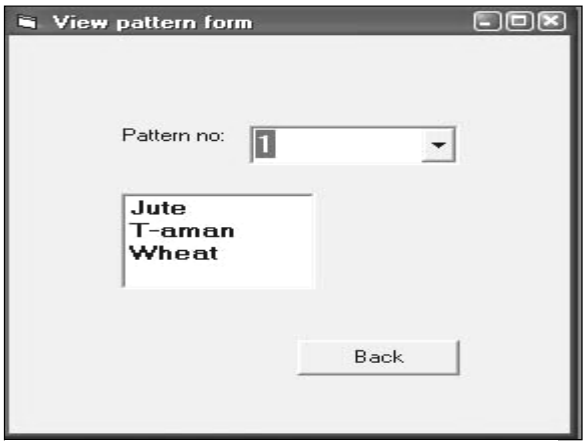

Figure 5. View Pattern form

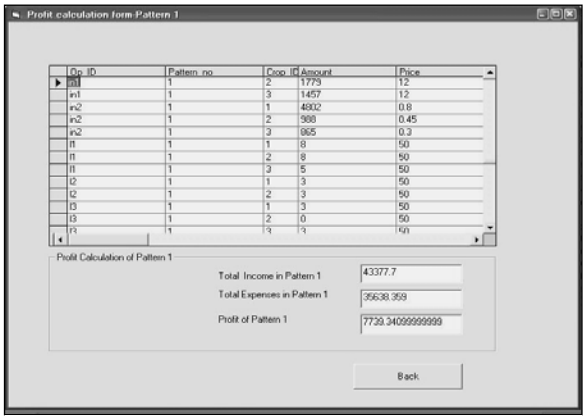

Figure 6. Profit calculation form for pattern-1

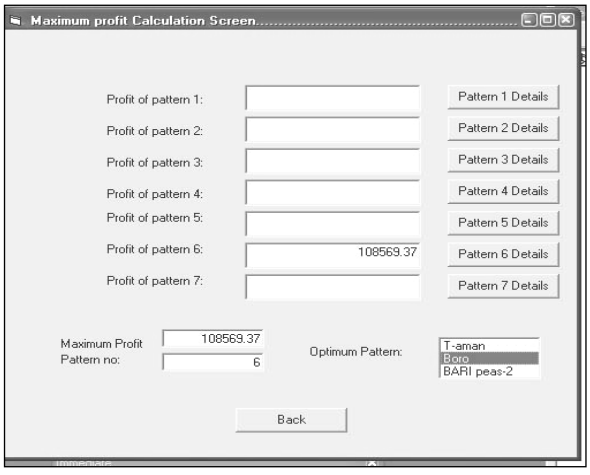

Figure 7. Optimum pattern calculation form

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