

The DairyCHAMP Program: A micro-computer based health and management program for dairy herds

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Summary

The DairyCHAMP micro-computer based dairy health and management system is described. The program allows herd monitoring, problem diagnosis and provides aids to management. It is easy to operate, flexible and educational for the user. The program operates under the PC-DOS operating system standard. The dairy farm processes which this program addresses are control of reproduction, mastitis, nutrition, disease, herd replacements, and herd inventory management. The program deals with system control, animal records, herd test records, milk production and feed use records, education, financial management and interfacing with other programs. Data entry is via programs selected via menus. These allow selection of information for recording from on-screen lists in English which are stored in the computer as code. Outputs may be viewed interactively or printed. They consist of periodic reports which allow key indices of milk production, disease, reproduction and heifer growth to be monitored. An evaluation report is for use in the analysis of clinical trials and comparative analysis of the performance of herds. It lists observations such as means, standard deviations, the number of observations ranges and confidence intervals for performance indices. Diagnostic reports allow performance to be analyzed in ways which allow causes for inadequate performance to be identified. The program has been designed to fit the operational needs of all types of dairy production systems around the world.

Introduction

The DairyCHAMP computer program is designed to support the operation of health and management programs on dairy farms. It supports herd management by providing management aid lists to farmers. It also encourages performance monitoring by calculating performance indices on the herd's demographics, production,

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reproduction, mastitis control performance, disease occurrence, calf survival, heifer performance, and culling with analyses being calculated in a standard way. This allows comparison to targets and aids the identification and solution of problems or the identification of opportunities to improve. Goals in developing this system were to achieve speed and ease of use, informative and educational prompts, and complete, consistent, accurate records with maximum flexibility to meet circumstances in dairying around the world. A feature of the program is that the user can choose to enter information to the level of detail which they desire.

Health programs for dairy herds have been advocated for many years in association with recommendations to support them using computerized information systems. Adequate accurate information is essential to the function of health and management programs. Performance targets are set as goals to direct efforts towards improving herd management and disease control. Records allow a herd's current performance to be compared to targets and allow investigation of why target performance is not being achieved if it is not. Health and management programs address the limitations to dairy herd production imposed by managerial as well as disease constraints. They address subclinical disease and managerial production limits which in many cases have greater financial impact than clinical disease.

The advantages of micro-computers over mainframe computers have been discussed previously.¹ Before developing the DairyCHAMP program, a number of micro-computer based dairy health programs had been evaluated and all had aspects which could be improved upon.² Evaluations of available programs at the University of Minnesota led to the conclusion that a more convenient and useful dairy program could be developed to meet our objectives for teaching veterinary students, research, and helping farmers through extension programs and direct veterinary service.

Components of health management programs include control of reproduction, mastitis, nutrition, disease, herd replacements, herd management and financial management³, which should all be addressed by a computer support system. To adequately address these needs, milk production and quality records must also be kept.

Materials and Methods

Micro-computers operating under the MS-DOS and PC-DOS operating systems were used in the Turbo-Pascal 5 computer language program development system in the development of the DairyCHAMP program. Programming was directed at epidemiological and veterinary issues such as the correct definitions of animals to be included in populations for different analyses, algorithm development and defining criteria of normal performance for consistency and error checking.

Modular programming allowed for parts of the program to be planned and implemented by different developers with interest and expertise in particular program modules. Individual users can also choose which modules they wish to employ. Modules developed are a system control module, animal record module, farm record module, herd test module and interface module. A milk and feed module, educational module, and financial management module are planned but not yet implemented.

Aspects of dairy enterprise performance required to allow adequate monitoring and management to occur were detailed early in the program's development. Emphasis was placed on animal health, feeding and breeding management. Codes were developed to support analyses in the performance areas identified. Codes allowed information about cows, their identification, location, parents, feed, production, diseases, and reproduction to be stored. The code list was sent to veterinarians and dairy experts in Asia, Australia, Europe and North America to determine if their needs and those of their clients for recording information about the dairy enterprise were being met. Their comments and suggestions were incorporated into the program.

Results

Data Entry

General: The DairyCHAMP program uses menu driven programs to capture animal and farm record data. A prompt line informs the user of the choices which are available and pressing the [F1] key shows a window on the screen which allows the selection of a valid choice. The default date is set to the current day but can be changed to past dates. A coded data storage structure is used to conserve disk space, and a data dictionary approach makes the recorded information readily readable to the user. A program converts the dictionary data into the computer code which is stored on disk, or from stored code to English as data is retrieved. This methodology means that synonyms can be selected and used—thus, event, disease, and treatment names can be replaced by synonyms which may be used locally or may be the names in another language. Data integrity is therefore preserved while allowing the ability to create terminology which is locally acceptable. Each farm may have its own data code list.

The data dictionary also allows the creation of codes for diseases, treatments and other data to be added by the user to the extensive initial choice. Thus, as new drugs are developed and released and new syndromes are identified, they can be added to the dictionary, but they remain distinguishable from the original codes. Routines have been developed which will allow the program to be modified to allow these added types of data to be analyzed. Thus, if a new disease is added by a user, the user may modify the disease list scanned to produce numbers for the periodic and evaluation reports so that the new disease is included.

Choices for a data entry field are displayed in a pop-up window by pressing the [F1] key or when an entry typed in is not unique or not recognized as a valid choice for the program. The appropriate entry can be selected using alphabetic keys, which jump the cursor to the first choice starting with the letter which is pressed or by scrolling through the alternatives using the cursor control keys. Pressing the return or right arrow key will move the selected entry into the records. Specific information may be added to dictionary selections from the data entry routines, including animal identification, farm locations, farm of origin for purchased animals and the identification of semen which is used but not stored on the farm.

Program Modules

Animal Records: Animal histories exist in the animal record module. They are stored in a form analogous to cow cards. A fixed length header component stores only a limited amount of specific data such as the cow's identification, parentage, lactation number, whether she is lactating or dry, reproductive status and location. Such information is required to rapidly sort cows into logical groups for analytical purposes. Another variable length part of the record stores information on events which occur in the cow's life such as herd entry, calving, estrus, breeding, disease, treatments and other events and findings. The events are added to this record as they occur and the record grows as more events are added. Each lactation record for a cow is linked to the previous and next lactation record so that they become a single logical record.

Error checking in the program includes a logical consistency check in data entry which, for example, ensures that animal types are consistent with events which are recorded for them. Error checking for biological consistency also occurs. All added or edited events are checked against previous and when editing, subsequent histories to determine if the event to be added is biologically feasible.

The animal record stores information which is used in generating many reports and management aids such as histories, lists of cows requiring breeding, heat detection, drying off and the like.

Farm Records: Farm records in the DairyCHAMP program store information which is pertinent to herd management but is farm level information and not individual cow information. Farm records include inventories

of feed available on the farm, semen inventory and an on-farm drug inventory. Another type of information which is stored in the farm data file is herd production levels as measured from bulk milk tank records, and details regarding quality factors such as the somatic cell count and butterfat percentage of the bulk milk shipped from the farm.

These records are used to manage and evaluate inventories and to produce reports regarding feed, drug and semen usage. Bulk tank milk records can be used to record and evaluate the milk being sold from the farm.

Herd Test Records: This module stores information from herd testing organizations relating to individual cow's milk weight, composition and quality as indicated by somatic cell count. This information aids in managing the nutrition and mastitis control of cows. This milk production information can be linked with other health and management parameters to allow evaluation of their impact on herd production performance.

Interface Capabilities: Since the DairyCHAMP program's data base can potentially contain such complete records about cows and herds, and since many excellent software programs exist, facilities in the program allow the transfer of data from the DairyCHAMP program to other programs such as DairyORACLE (Optimization of Reproductive Activity in Commercial Livestock Enterprises), Lotus 1-2-3 spreadsheet programs and others in ASCII format. The DairyCHAMP program is capable of receiving code in ASCII format from other programs such as DHIA programs, automatic transponders measuring milk and feed, milk temperature, conductivity and from automatic electronic scales.

Educational Components: To overcome the fear of users being overwhelmed by data without their knowing how to use it, the program was designed to have 3 levels of educational assistance. At the first level, consistency check routines contain helpful and educational messages which aid the user. This part of the program is already implemented. Other methods of education within the program are proposed.

Financial Components: Records of feed supplies, drug and semen purchases, and milk and animal production levels from the dairy herd provide a very large part of the necessary information for a dairy enterprise budget and for a dairy enterprise financial record system. The ability exists to develop such systems with the aid of agricultural economists to capture the information from this health and management production record modules and to integrate them with these financial functions in a financial module.

Output Formats

The function of the DairyCHAMP program's outputs are to aid with management, allow the identification and diagnosis of problems and opportunities for improvement, and to allow the performance of herds to be monitored in areas which are relevant to the aims of the producer man-

aging the dairy enterprise and others serving the producer, such as veterinarians. Reports may be run on data which is nested by breed, location, lactational age, user defined group or mixes of these classifiers. The ability to analyze performance in this way allows epidemiological risk factors to be considered when examining a herd's record for inadequate performance. Whole herd analyses may also be run which would normally be used for herd monitoring.

Periodic Reports: Periodic reports of key areas of herd performance including herd demographics, milk production, reproduction, mastitis, disease, heifer growth, calf survival and culling are produced. In these, the period under review can vary from 1 day to years. Up to 12 baseline periods are specified and they, along with their mean and performance in the current period are reported. In periodic reports, data are the latest available for the index being calculated. These reports therefore consider different populations for different indices. Periodic reports are management oriented reports which are tools in the day to day monitoring and management of the herd.

Evaluation Report: This report is a 1 page output of key production related indices, all calculated on cohorts of animals defined as those calving or being born in a period. This report provides thorough descriptive statistics such as arithmetic and geometric means, binomial mean where appropriate, standard deviations, the number of observations, the range for observations and the confidence interval for the mean at a P level specified by the user. This report is for use in the evaluation of clinical trials and comparative analysis of the performance of herds.

Diagnostic Reports: These provide measurements of herd performance in ways allowing causes of inadequate performance to be identified. Reports for mastitis provide indices for monitoring mastitis incidence, prevalence and infection elimination rates. The facility to graphically evaluate heifer growth performance against standard curves, to run cumulative sum graphs for conception efficiency, plot milk production curves with standards for herds and curves for individual cows allow problems and opportunities to be identified. Other diagnostic reports allow conception efficiency to be calculated by inseminator and bull. Further reports will be developed as the need is demonstrated.

Data Base Applications: A third type of reporting process allows the user to define and develop their own reports. These can be reports which are routinely required by managers but are not available as standard reports. Users may also require the ability to do data base searches when conducting a diagnostic problem analysis which is suggested after viewing a periodic report output or other monitoring report. Many pre-defined variable names have been included in the program to allow users to search the data base. These include items such as the identification of animals, their group, location, pen, feed group and other similar demographic information. Events and intervals such as days open are also available as data items which can be used in the data base management sys-

tem as well as production and treatment information.

Information can be defined by the use of a where clause which is an expression limiting the data to be displayed or analyzed. Where clauses can include variable names, arithmetic operators, relational operators, logical operators (AND, OR, NOT) and the functions EXISTS and FAILS. Dates can be used to set starting and ending periods for data searches.

Several styles of reports are available using the data base applications procedure of the DairyCHAMP program. These include a facility to list data in a format of one record per line. Many variables may be listed on a line of output. A tally facility allows a count of the occurrence of discrete variables to be made. A frequency table and relative frequency histogram are displayed for each variable. The cross tabulation facility produces a contingency table with column and row variables being any discrete variable. A statistical option allows numbers of observations, arithmetic means, sums of squares, standard deviations and standard errors of means to be calculated. A histogram program allows histograms of continuous variables to be displayed. A scatter plot facility produces a scatter plot for pairs of variables. A time plot displays the relationship between a variable and a date variable.

Conclusions

The DairyCHAMP micro-computer based herd health

and management program offers a management facility for dairy herds regardless of size. It has a complete, convenient and helpful input format. The standard report designs provide management and monitoring information for herd managers and scientifically valid analytical formats for veterinarians and researchers working in dairy herds. The program has achieved simplicity and consistency of operation while retaining flexibility and speed.

The DairyCHAMP program will allow veterinarians around the world to work in cattle health and management programs in confidence that analyses are being conducted in an epidemiologically sound and consistent manner. The program has considerable complexity of design, but a simplicity of use which will make it valuable in a spectrum of situations in developed and developing countries. It gives the power to both practicing herd management veterinarians and research workers to study and document the relationship between health, efficient management and productivity.

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