

UC  
CE

COOPERATIVE EXTENSION  
UNIVERSITY OF CALIFORNIA, DAVIS



## SHIELD (version 5.0) Dairy Ration Evaluator

**P.H. Robinson**

**Cooperative Extension Specialist**

**University of California, Davis, CA 95616-8521**

SHIELD has been in development since about 1980. Originally published as the New Brunswick Protein Program (NBPP) in 1992, it was subsequently renamed The Atlantic Protein System (TAPS) in 1995. There were substantial changes to the program associated with this name change that related to calculations of intestinal delivery of protein and animal requirements for dietary protein fractions. In addition, amino acids were added. Early in 1998 the program was renamed SHIELD. This name change was associated with a substantial increase in the numbers of feedstuffs included in the feed dictionary in order to make it more reflective of all feedstuffs utilized in dairy rations.

The available version contains the final release of the NBPP (Version 3.3) as well as the final release of TAPS (Version 5.0) which is now referred to as SHIELD (Version 5.0) due to changes to the feed dictionary. SHIELD is currently under redevelopment to a Windows compatible format.

### **Purpose of SHIELD**

This program was not developed as a ration formulator nor was it developed as a stand alone ration evaluator. SHIELD is designed to be used in one of two ways:

*In ration formulation*, it should be the second step in a process whereby another approach is first utilized to formulate the ration for all nutrients including energy, protein, minerals and vitamins at a minimum. This ration can then be used as input to SHIELD for an evaluation of its protein, amino acid and energy status. This approach utilizes SHIELD to create a biologically feasible ration for a group of lactating dairy cows.

*In ration evaluation*, any published or known ration that describes known performance of an actual group of cows can be evaluated for its protein, amino acid and energy status. This approach utilizes SHIELD to identify potential nutrients that limit performance. It can also suggest limitations of SHIELD by identifying rations that SHIELD predicts to be infeasible that, based on actually measured animal performance, are actually feasible.

SHIELD has few user safeguards and will allow the user to input impossible criteria, such as desired milk fat levels of 50% or a crude protein level of 90% in corn grain. Thus

users are urged to use caution in their input. However, this approach allows SHIELD to evaluate extreme, possibly biologically impossible, conditions if the user so desires.

## **Use of SHIELD**

SHIELD is a completely contained program that requires no user supplied software. It can be operated from the disc or loaded to a hard drive. All files are included in the folder entitled 'Shield'. SHIELD comes loaded with an example ration. It might be best to review it before setting up your own rations.

To initiate the program, double click on the SHIELD icon. You will then see the:

### *Entry Screen:*

Version 3.3 (option 1) is the old NBPP. This program only evaluates rations for their protein and energy status. This version also evaluates protein and energy status utilizing NRC (1989) equations. Option 2 is a subprogram which allows the user to create a compound, or new, feed for addition to the Version 3.3 feed library.

Version 5.0 (option 3) is the old TAPS with a library upgrade. This program is the version to use if you wish to use the current equations and feed library data. Option 4 is a subprogram which allows the user to create a compound, or new, feed for addition to the Version 5.0 feed library.

NOTES: Versions 3.3 and 5.0 are separate programs.

The potential size of the feed library is limited to five new feeds.

Option 5 returns the program to windows.

### *Farm Information Screen (F1):*

This screen includes a number of fields to identify the user and the evaluation.

### *Animal Information Screen (F2):*

This screen includes a number of fields to identify the animal and its performance. Except for the top two descriptor fields and the lactation number, all entries will impact the predicted nutrient status of the cows. SHIELD should only be used to evaluate performance of lactating cows. Although a milk production of zero will be accepted, the predicted outputs will be unreliable.

### *Select Feeds Screen (F3):*

This screen verbally describes the feedstuffs that are in the Feed Library. Scroll through with the arrow keys and select desired feedstuffs for the ration to be evaluated by pressing the F3 key when the desired feed is highlighted. The same feed can be selected multiple times, although the total number that can be selected is limited to 15 feeds.

NOTE: Before selecting feedstuffs, proceed to the F4 field and delete the current ingredients by scrolling to that line with the arrow key and pressing 'delete'.

*Feed Information Screen (F4):*

This screen will include all user selected feedstuffs from the F3 screen. SHIELD predicts a DM intake, however the user has the option to select it or another value (the cursor will be blinking at this entry).

NOTE: The predicted DM intake is for mature cows. Predictions for first lactation cows may need to be discounted. DM intake is highly variable for groups of cows of all parities. The predicted value should be considered as a guide.

Scroll through this screen with the arrow keys. The user must enter a DM intake and describe the diet as a percentage of DM intake. The user has the option of over-riding the library values and entering CP, buffer soluble CP, indigestible CP, NDF, NEI and cost values. The NEI values are 3X maintenance values, which SHIELD will adjust for the actual level of energy intake. The predicted DIP and UIP proportions of each feedstuff is predicted by SHIELD based upon predicted rates of rumen passage and digestion for the specified level of DM intake.

*Protein Evaluation Screen (F5):*

This screen is an output screen that evaluates the protein and energy status of the ration as well as indicating the nutrient profile of an ideal diet.

*Amino Acid Evaluation Screen (F6):*

This screen is an output screen that evaluates the amino acid status of the ration.

*Ingredient Intake and Costing Screen (F7):*

This screen is an output screen that indicates intake of each ingredient (kg/d) and the cost.

*Print Option (F8):*

This option prints a two page summary report.

*File Retrieve/Save/Delete Screen (F9):*

This screen allows a ration to be saved, deleted or retrieved.

NOTE: all ration files must be of the form **xxx.TAP**.

Scroll through this screen with the 'up'/'down' arrow keys and select the ration to be retrieved/deleted with the space bar. Use the 'enter' key to retrieve or delete.

### *Escape Key:*

The session can be terminated at any time by pressing the escape key.

### **How to Interpret SHIELD Output**

When evaluating the SHIELD output on the F5 screen, the suggested sequence of examination is:

*NEI balance:* The NEI calculations are based upon NRC (1989) equations and the balance should be very close to zero. If the difference between the predicted and required NEI values exceeds 1 Mcal, this indicates that there is likely a problem in any or all of the animal criteria, the estimated NEI values of the feedstuffs, or the DM intake. This difference should probably be corrected before proceeding to examine any other parameters.

*NDF intake:* Intakes of NDF by groups of lactating dairy cows seldom exceed 1.40% of body weight. If the estimated NDF intake is greater than this value, then you should check the specified BW of the cows, the specified NDF values of the ingredients and the specified DM intake of the cows. While NDF intake may actually exceed 1.40% of body weight, it is not likely for groups of cows unless the rumen fermentability of the NDF is high.

*Digestible UIP balance:* This balance indicates the absorbable protein balance. Negative values indicate that the diet will not provide sufficient absorbable protein (i.e., the ration is biologically unlikely or not possible) whereas positive values indicates that it will provide sufficient absorbable protein. Deficits of soluble DIP and/or insoluble DIP do not indicate that the diet will not meet the specified level of performance, as they will depress predicted bacterial growth and result in higher predicted requirements for digestible UIP. However correcting imbalances in soluble and/or insoluble DIP will improve the efficiency of N utilization and may reduce requirements for digestible UIP.

The SHIELD amino acid output on the F6 screen indicates delivery of total and digestible amino acids as well as the predicted requirement for absorbable amino acids. Any amino acid below 105% of requirement should be considered to be potentially limiting performance while any amino acid below 95% of requirement indicates a deficit that is likely too large to allow the stated level of performance on the stated intake of DM. Adjustments of the most limiting of lysine or methionine to bring the lysine/methionine ratio to the ideal may result in performance enhancement even when both are supplied at levels in excess of 100%.

NOTE: SHIELD will not accurately reflect actual animal protein status for cows in very early lactation (less than 10 days postpartum) with high milk yields relative to DM intakes. This may reflect metabolic adjustments to animal maintenance protein requirements that SHIELD does not currently predict.

## Files in the Shield Folder

There are a number of files in the Shield folder. Not all are user accessible. Those that are include:

- Aa.txt - This file describes the assumed AA composition of rumen escaping bacteria, the assumed AA composition of milk and tissue and the assumed efficiencies of utilization of absorbed AA's for maintenance and milk protein synthesis. These values can be changed by the user.
- ShdVER5.xls - This is an EXCEL file that includes the entire Feed Library with descriptive headings. It is not the file that SHIELD runs off. This file can be printed to create a reference feed library
- Tapsver3.dat - This is the feed dictionary file used by version 3.3. This file can be modified by the user.
- Tapsver5.dat - This is the feed dictionary file used by version 5.0. This file can be modified by the user.

No other files are user accessible.

## Questions and Obtaining a Copy of Shield

SHIELD is a ration evaluator for lactating dairy cows that is designed to be used in conjunction with another system which first formulates the ration for all nutrients. However it can also be used to identify potentially limiting nutrients in ration/animal situations that are known to have occurred. SHIELD is currently under development to a Windows format.

SHIELD generated output should be used as a guide to formulating rations for dairy cattle. The University of California and the author make no claims as to their accuracy.

To obtain a copy of SHIELD at no cost, you should write, FAX or E-mail:

Peter H. Robinson

Associate Cooperative Extension Specialist  
Department of Animal Science  
University of California  
Davis, CA 95616

\* \* \* \*

P.H. Robinson is a Cooperative Extension Specialist responsible for dairy cattle nutrition and nutritional management. He can be reached at: (530) 754-7565(voice) or (530) 752-0172(fax) or [phrobinson@ucdavis.edu](mailto:phrobinson@ucdavis.edu)(office) or [lovenbu@pacbell.net](mailto:lovenbu@pacbell.net)(home).