

DairyComp 305 Newsletter

Number 20

Fourth Quarter - 2001

2001 is a year that will not be soon forgotten. Here in Tulare the year's milk prices started out very low, rose to pretty high levels and seem to be heading back down as this is being written. September 11th has certainly been a day that has changed our lives. Varying milk prices become a small concern. We also realize that we live in a world that consists of more than cows and milk. Those about whom we know little and think of even less can have a major influence in our lives. Terrorism is a daily fact of life for many in the world. Some on a national scale and some (as in Mexico) on a personal level where fear of kidnappings is constant amongst many dairymen. We hope and pray that conditions around the world will improve.

At Valley Agricultural Software we are continuing to try to provide good service to the dairy industry. Our major push has been to get our Feed Watch Program up and going. Unfortunately, as with many software programs, this has taken longer than anticipated. However, it can be reported now that we're on the home stretch and believe that by the time you are reading this, we'll have a program ready for sale and use. We were also having difficulties with some of the hardware that we're using. However, in the last few weeks we feel we have solved these problems and should have consistent production supplies by the end of the year.

Additionally, we are working on programs and changes we believe will be helpful to dairymen and/or the dairy industry. We continue to work on Dairy Comp 305 features to make it an outstanding management tool. We are implementing additions that will take advantage of the Internet for backing up, distributing data to consultants, providing data integrity checking and collecting and sending creamery data to users. As these become available, we will let you know. This will occur using news releases on our Web site and through mailings.

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While much of the technology is presently in place for us to accomplish most of this, there are a few things we need to do to get this fully operational. The basis for much of this is Internet access. The Internet offers a phenomenal technology for computer data transfer without using long distance calls. Unfortunately, it also offers access to information that is not necessarily desirable. Many dairymen don't want Internet access available in the barn so workers can play or use its access for personal reasons. Security is also an issue. To the first issue, ways of setting dialup connections that have limited access to the Internet are coming. These will be embedded in

our software so it is virtually non-apparent to the user.

Regarding security, methods are available to transfer information securely and control who has access to it. (We used them for DHIA data transfers for years.) This is done primarily with identification codes, passwords and programs that can limit outside access to data. Banks, financial and credit institutions have successfully used this with good success. This leads us to trying to have unique numbers assigned to our users. For those testing through DHIA, DHIA herd numbers are unique to each dairy. It is possible for non-DHIA dairies to have these numbers assigned also. In this manner a system could be in place that would have a single, uniform format. It could be used by many different organizations (co-ops, consultants, labs, etc.) and us. There is a hint that the Federal Government might start assigning numbers to dairies in the future. We believe that if this occurs, it would be in the dairy industry's best interest to have a system in place that can be used, not one that would be designed and forced implemented by the government. We are looking into the possibility of having anyone who wants to have DHIA numbers assigned to their dairy whether or not they ever test through this organization.

Thus, when we have a fully operating system in place, dairymen would be able to backup their data off-site to our server and allow others, whom they designate, to have access to this data. In addition, other data such as that supplied by the creamery could be available to the dairymen and/or whoever else is given access to it.

Support

Providing program support is a big part of our daily life. There are 6 to 8 people within our organization working on support for DC305 at any given time. We recognize this is a necessary and valuable portion of selling our program and appreciate being able to give help to our users. In a like manner we appreciate the high user acceptance rate of our update and support plans. We continue to try to make our support system more efficient all the time. We balance between having enough good people available to give quick support and the amount this costs. We'd like to keep our costs and prices as low as possible while still provide good, efficient help.

We recognize that most dairyman don't have the time to wait around the office until we get a chance to call them back. We do keep call logs; dairies are called back and often no one answers the phone when we do. If message machines are there, we do leave messages. One solution to this dilemma is to make appointments for support. While this is not always suitable or possible, it often is a good alternative to playing phone tag. When our phone system answers, hit "0" and get to the operator. Tell her that you want to set up an appointment for support at a mutually suitable time for both. At the office, the operator ("0") is answered by a person from 8:00 AM to 5:00 PM (California time) Monday through Friday except holidays.

New Equipment

New computers and operating systems continue to come on the market frequently. This year has seen Windows 2000 and ME become almost all that is available. As the year closes, new XP Windows is being offered on new machines and/or a free upgrade for those who buy Win-2000 or Win-ME. So far, both the Windows and DOS version of

DC305 works on all these computers. There are some things to be aware of however. While the program does work, peripherals sometimes do not. We became aware of printers and modems that will only work with Windows programs a few years ago. Other things fall into this category. Hardlocks that are being used do not work automatically on the new XP machines. We've found other drivers that fix this problem. DOS printing becomes a bigger problem. A couple of aspects of our program didn't run quite right on the XP's but those have been fixed and, as far as we know the program now works fine. Other windows programs have trouble also. Our current recommended remote program, LapLink-2000, does not work with XP operating systems. A fix is coming.

For those who are brave, buying the first new operating system or computer that hits the market can be a thrill. However, especially with sophisticated program setups such as networks and interfaces with other equipment, this is sometimes not a thrill worth having. While we do try to keep current, we don't always buy the latest systems as soon as they hit the market. At the least this gives us time to let early bugs be found and fixed and it has kept us from getting equipment that has turned out to be of little value or just a fad.

CLEANUP

A new feature has been added to CLEANUP that searches the cowfile for data discrepancies. It is called by adding a "\4" switch to the command – CLEANUP\4. The procedure goes through the cowfile and prints out a list of problems it finds. This includes, as an example, LACT>0 FDAT=0 or RPRO=BRED HDAT=0. The way the procedure works is to go through the cowfile and, for those records that have a data error, it puts a code into the cow's record and then prints out a list of all cows whose code is greater than "0". By default this code is written to the item "COD1" but this can be changed to another item if needed by adding the item to the command such as CLEANUP CODA\4.

Some will want this function to run as a scheduled task periodically. One can fit the command CLEANUP COD1\4 into the scheduled tasks directly or this can be put into a command abbreviation and put into the scheduled tasks.

For those who would like a more extensive review of their cowfiles, we are developing a series of in-house commands to look at data integrity. For those interested in this contact our support staff and make arrangements for this to be done on your cowfiles.

BREDSUM – Pregnancy Rates

With the current cost of replacements, and also the high value of female calves, monitoring the reproductive performance of the dairy is crucial. Pregnancy rate is a significantly more powerful tool than the traditional measurements of average DIM, Days-Open, or Calving interval. Because Pregnancy Rate is a relatively new tool, many questions continue to arise about it. As this feature of BREDSUM is increasingly being used, the following is offered as a review and explanation of this calculation and its intended use.

The Pregnancy Rate calculation looks back through the cowfile forming 21-day intervals. It then determines what percentage of the cows eligible to be bred or get pregnant, where bred or did become pregnant during each interval.

BREDSUM.E											
Date	Ht Eliq	Heat	Pct	Pq Eliq	Preg	Pct	25	50	75	100	
8/23/00	129	86	67	127	19	15	P			H	
9/13/00	169	110	65	165	34	21	P			H	
10/04/00	190	142	75	186	50	27	P			H	
10/25/00	167	110	66	163	30	18	P			H	
11/15/00	155	113	73	147	37	25	P			H	
12/06/00	151	105	70	146	38	26	P			H	
12/27/00	147	109	74	145	35	24	P			H	
1/17/01	142	77	54	138	24	17	P	H			
2/07/01	142	89	63	141	22	16	P			H	
2/28/01	157	119	76	152	34	22	P			H	
3/21/01	183	126	69	158	40	25	P			H	
4/11/01	155	93	60	148	23	16	P	H			
5/02/01	177	128	72	152	31	20	P			H	
5/23/01	150	109	73	144	35	24	P			H	
6/13/01	139	93	67	132	28	21	P			H	
7/04/01	122	77	63	118	26	22	P			H	
7/25/01	119	83	70	0	0	0	Undet	Preg		Stat	
8/15/01	127	105	83	0	0	0	Undet	Preg		Stat	
Total	2475	1686	68	2362	506	21	P			H	

This pregnancy rate table was run on September 5. 8/15 is 21 days ago and the dates above that are shown in 21-day intervals for the past year. Looking at the date 5/23/01, there were 150 animals eligible to be bred during that 21 day interval beginning with this date. 109 were bred which represents 73%. 144 were eligible to be found pregnant of which 35 were for a 24% pregnancy rate for that interval. The difference in those who were eligible for breeding vs. eligible to get pregnant represent those who left the herd in a later interval, therefore not available to be found pregnant had they been bred. The bottom line displays the totals and averages for the year. Of interest are the last two heat percentages. These tell the latest heat detection rates and, in this case, might be showing an early response to the end of summer breeding. These numbers will decrease as cows re-cycle or are found open. However, these are the first indicators of change in heat detection and when they go down it is an early indication of potential future breeding prob-

lems. While these figures do decrease, they rarely, if ever, increase. The totals at the bottom of this report do not include these last two periods.

The voluntary waiting period (VWP) is defaulted to 50 DIM. If this is different, use a Vnn switch with the BREDSUM command to designate a different VWP. Thus, BREDSUM\V40 will calculate the Pregnancy Rate Table using a 40 DIM VWP. If no number is used after the V in the switch, one is prompted for the VWP.

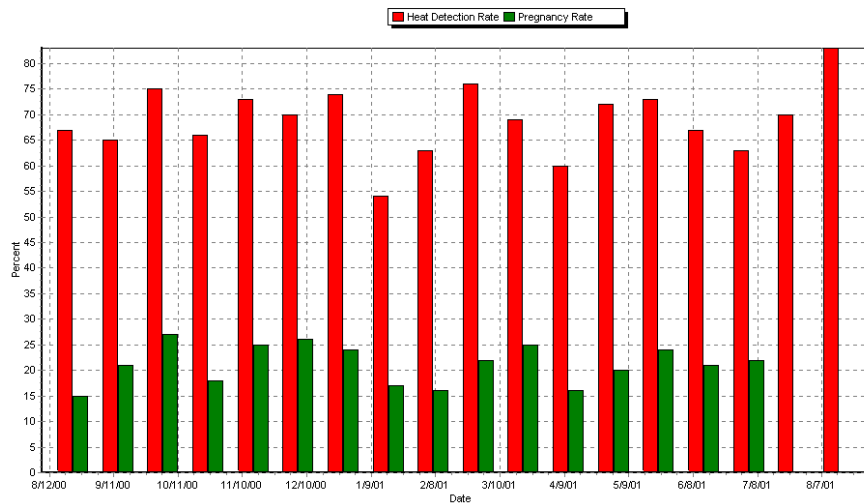
BREDSUM\R will display the breeding results by DIM instead of the calendar dates.

BREDSUM\R										
DIM	Ht Eliq	Heat	Pct	Pq Eliq	Preq	Pct	25	50	75	100
50	1301	739	57	1153	231	20	P	H		
71	824	511	62	792	162	20	P		H	
92	565	351	62	556	130	23	P	H		
113	268	188	70	257	71	28	P		H	
134	64	56	88	63	11	17	P			H
155	14	13	93	12	4	33	P			H
176	11	6	55	11	0	0		H		
197	11	7	64	9	2	22	P		H	
218	15	9	60	12	2	17	P	H		
239	14	2	14	13	0	0		H		
260	12	3	25	11	1	9	P	H		
281	12	4	33	10	1	10	P	H		
302	9	3	33	8	1	12	P	H		
323	6	2	33	4	1	25		PH		
344	4	0	0	4	0	0				
365	4	1	25	2	0	0		H		
386	4	1	25	4	0	0		H		
407	3	1	33	2	0	0		H		
449	1	0	0	1	0	0				
470	1	0	0	0	0	0				
491	1	0	0	1	0	0				
512	1	0	0	1	0	0				
533	1	1	100	1	0	0				H
617	1	0	0	0	0	0				
638	1	0	0	1	0	0				
Total	3148	1898	60	2928	617	21	P	H		

When looking at this chart it is important to remember that only those 21-day intervals that have a significant number of eligible breedings should be evaluated. The 12% at 302 DIM and the 25% at 323 DIM are not important. In this chart, nothing after 134 DIM is really significant. The difference in the total numbers at the bottom of this chart and the calendar based chart are due to the positions of the cows at the beginning of each calendar interval vs. all cows starting at 50 DIM in this second chart. It is also important to realize that the average percentages are not averages of the percentages in each column but the average of the totals. Thus 21% overall pregnancy rate is 617/2928, not the sum of the last Pct column divided by the number of intervals shown.

New Features

New graphing features have been added to the pregnancy rate tables. When the table is created, if one clicks on the “Graph” tab at the bottom of the report, at bar graph of heat detection and pregnancy rates is made.



BREDSUM (Pregnancy Rate) Summary

Pregnancy rate is the percent of all eligible cows that get pregnant during a 21-day interval. This is distinctly different from conception rate that looks only at the percent of cow bred that get pregnant.

By default, the procedure looks only at adult cows in AI pens using a voluntary waiting period (VWP) of 50 days. Switches are used to change this.

- \E The menu choice to run the pregnancy rate automatically.
- \Vnn Set VWP \V60 sets VWP to 60 DIM.
- \U Analyze breedings in the bull pens.
- \A Analyze all breedings, AI and bull pens.
- \D Specify date range.
 - Dnn Specify number of days. Thus \D180 looks at the last 6 months
- \Y Includes young stock. Use BREDSUM FOR LACT=0\Y for heifers.

As with other reports that use archive files, these must be configured correctly for proper use. For single herd installations the archive files should be located with the data file (usually COWFILE1.DAT), the CLEANUP settings say the archive file is on the hard drive (usually "C"), and a parameter in SETUP specifying where multiple archive files exist (ARCP C:\DC305). For those using multi-herd configuration, the CLEANUP setting should have an "*" as the archive drive and no ARCP in the SETUP parameters.

Plots and Graphs

Four commands exist that are somewhat confusing and overlap in many peoples' minds. These are PLOT, GRAPH, EPLOT and EGRAPH. In an effort to make this easier, we've allowed crossover in using these commands by allowing the program to "guess" at what the user wants.

Command description:

PLOT – Graphs milk production data from page four in test day order. Often used for lactation curves.

GRAPH – Graphs data in one of 3 modes

1. Bar Graph or Histogram – GRAPH DIM FOR LACT=2 - shows a bar graph of the number of cows a various DIM for lactation 2 cows
2. Scatter graph of 2 data fields – GRAPH MILK BY DIM – displays the milk on the Y axis and the DIM on the X axis of each cow's current milk production.
3. Survival graph – GRAPH DOPN\S – displays a survival graph of DOPN for the whole herd

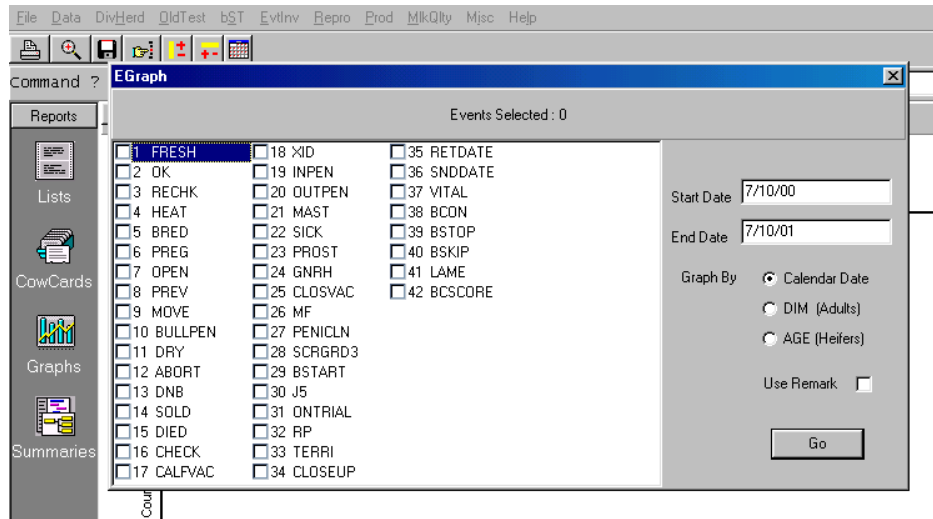
EPLOT – Graphs the data entered associated with events that record weights, heights or body scores.

EGRAPH – Graphs data from events

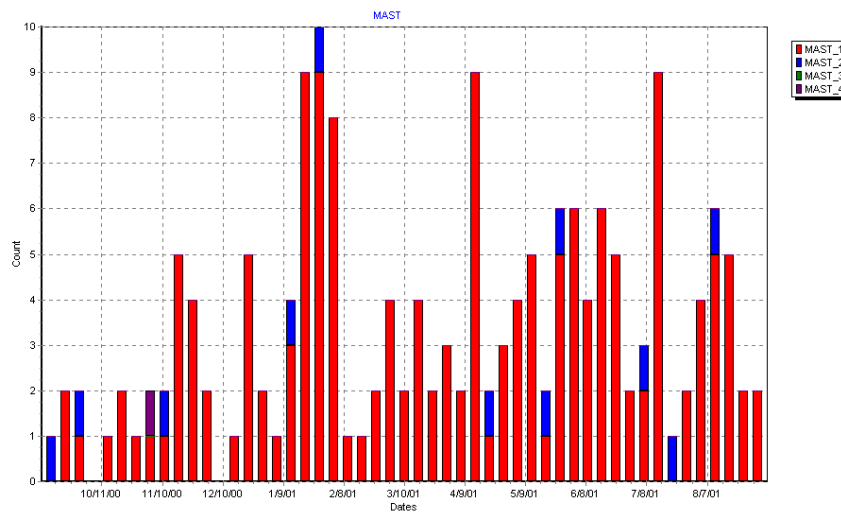
The program will try to interpret what is desired so if one types PLOT MAST or GRAPH MAST, it will know that an event graph is desired and actually runs an EGRAPH of the mastitis event. On the other hand, PLOT MILK and GRAPH MILK will give different results, as both are legitimate graphs. The first is a graph of the milk from the test day page (a lactation curve) and the second is a bar graph of the number of cows giving various amounts of milk.

EGRAPH Discussion

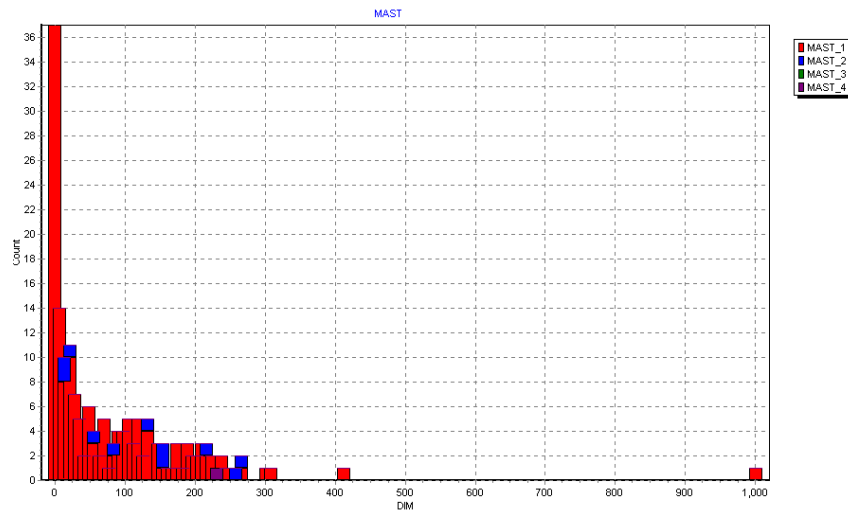
A short discussion of this program feature follows since it is relatively new and has not been widely used. Type EGRAPH at the command line and a screen similar to the following will appear.



One can click on the event(s) desired, change the date range and select calendar or DIM graph. Clicking on MAST and leaving the rest the same will produce a graph similar to the one below.

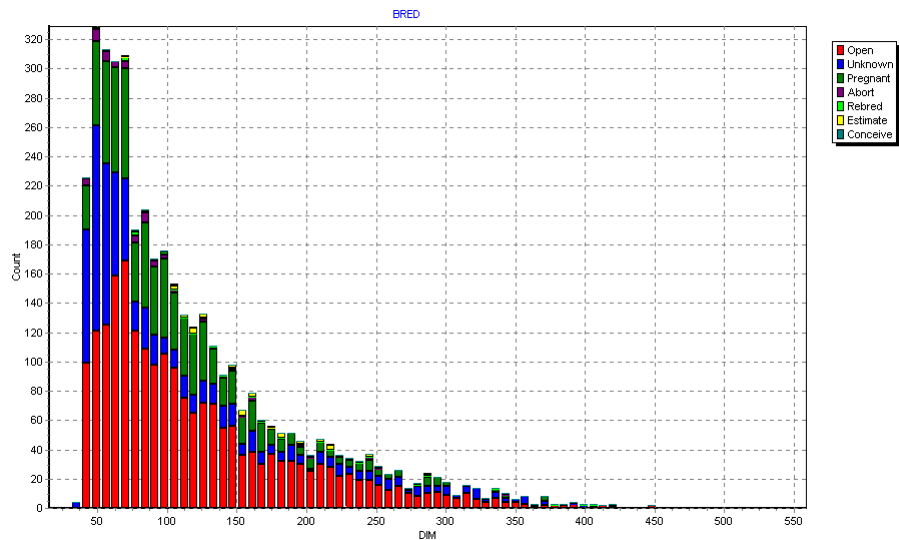


Using the DIM selection, the following is made.



If remarks are used, the first character of the remark is used to differentiate the mastitis events instead of the number of times MAST has been put into a cow's record. Some have used this to record a culture event when the results are recorded as 1-letter codes.

If remark is used with the breeding event, the breeding result code is taken as the remark and makes a graph as shown.



Sires

Changes are coming in sire names that the new program will reflect. The first is that sire names (NAAB Codes) have gotten longer. 100H12345 is now a possible sire name. This exceeds the 8 character limit of our current system. We will now allow these sires to be added automatically into the sire table. We actually do this by “packing” numbers which means storing them at more than one character per byte. We can now store any bull code up to 32000 and stud code up to 999.

The sire names are stored in a table in the cowfile and items and events reference that table for the sire names. The table in the current cow file will hold 2048 sires, which is plenty for the vast majority of our users. However, with increased dairy sizes and the high use of small numbers young sires by some dairies, this sire table size has become a limitation for some dairies. After the current updates are distributed, any dairy that needs to increase their sire table may have us double the sire table size. This will break consultant and DHIA tester versions of the program who use these data files, but these can be upgraded also. We are making the latest version aware of the possible data file difference so it will know and notify the user if a cowfile with an expanded sire table is encountered.

ALTER

- Phone and modem changes have been taken from ALTER and put into the command CONNECT.
- For those who need to set up groups and new item type 55 returns a random number between any two numbers to break up cows into equal and random sub-groups. This can replace the odd-even tag number we often use for trials. Repeated use of odd-even ear tag numbers when running trials can produce major result errors. Give support a call if you have the need for this.
- ALTER\R6 will run the next past-due scheduled task thereby eliminating the need for the program to wait for 5 minutes until doing so.

Miscellaneous Changes

The following is a list of changes or improvements that have been made to DC305 which bear reporting.

Bull dates have always been set whenever a cow is moved from a non-bullpen to a bull-pen. Often, when a cow is moved from a bullpen into a non-bullpen and back, a new BULLPEN event is put into her record and the bull date is changed. With these updates, if an existing BULLPEN event is in a cow's record no new BULLPEN event is added to her record and the bull date, heat date and repro codes remain set by the first BULLPEN event.

In rare cases, it is necessary to run DC305 with external files. This has been possible from DOS for a long time. We can now run the Windows version of DC305 from external files that are called “script files”. If you have need for this, call support and we’ll get needed documentation to you.

For those using our multi-herd configuration, we can now have menus placed in the sub-directory with each cowfile and have the program call the menu associated with the cowfile when it is opened. This is especially good for consultant users that pull daily backup from dairies and want to be able to see DC305 exactly how their client sees it. To set this up, go to SETUP, Parameters and add the parameter MENU and put its content to 1.

ATA Permanent ID’s

For those who DHIA process through AgriTech, changes are occurring with the permanent ID that need to be considered. Historically, permanent ID’s were either a USDA number or a registration number. USDA numbers (such as 93VAB1234) had a typical format that was recognized as being used for grade-cow identification and registration numbers were all numeric (12345678). Now the “American ID” is being used by DHIA organizations that is all numeric and shows no distinction between grade and registered animals. This is further complicated with the continued use of USDA type numbers that are used for Brucellosis identification tags and are still acceptable as a permanent identification for DHIA purposes.

Historically, we’ve always put the USDA into the USDA field and the registration number into the REG field. ATA looked at the data format and determined if this was a registration number for a purebred or a USDA number for a grade cow. Comparisons made during the barn sheet routines would handle this properly. Now, with American ID use, we find our logic no longer works. Due to this the program now changes American ID numbers and puts them into the REG item when it sees a difference. It notifies the user when this occurs. Notice this is a one-time occurrence and, once done, it will not need to be done on the same cow’s records a second time. To avoid seeing this, if American ID numbers are being used for permanent ID’s, enter these into the REG item in DC305.

Backups

There are 3 primary reasons we have found for backing up: Error Recovery, Recovery for Historical Reasons and Disaster Recovery. Error Recovery is what we call the daily backup and is used to recover either the complete or partial dairy data. Recovery for Historical Reasons is for looking up something from the past, a certain time span. This might be for research, accounting or other reasons. Disaster Recovery means a complete backup of your system and is used when the whole computer system fails.

How one recovers from their errors depends on what is needed. This can vary greatly and that discussion is beyond the scope of this newsletter. What we are trying to do is to focus your attention on good methods of backing up so you can recover whenever and

from whatever befalls you. The better one understands data and file management in a computer, the easier and more logical all this becomes. If data is properly backed up, our support staff can easily help you recover whatever is needed.

Backup for Error Recovery

This is the type of backup where you need to replace all or part of your records. This could be someone moved all the cows into pen 0 accidentally or a cow was sold 2 months ago and has suddenly re-appeared and her record needs to be found and replaced.

We have developed a series of batch commands designed to back up the dairy data. These are collectively called “Daily Backups” (for the frequency we hope you run these). We upgrade these as hardware and program changes occur and we write about these so current users can upgrade their backup methods as their systems are replaced with newer computers. DB.BAT was written to store data on a 3-½ inch disk. This basic procedure has been used for a number of years and has been modified as programs and operating systems have allowed. With bigger data files (and poorer quality disks) we find ourselves about at the end of the usefulness of these disks, especially for dairies milking over 1000 cows.

ZIP disks have become available in the past couple of years and we highly recommend switching to these for backing up. These come in 100 and 250 megabyte sizes and, as one would guess, we recommend the larger 250 megabyte disks. We have written daily backup batch files for these and will be happy to provide them to you. There are number of advantages to these disks.

1. Reliability - We've seen few failures in writing data to these disks so far. Unlike the 3-½ disks that fail between 5 and 20% of the time, zip disks have failed less than 1% of the time in our experience.
2. Size – Because of their size, whole directories can be copied to ZIP disks, thereby having both the data files and the program on a portable disk. While the disks can be filled, it is not common to do so. With a little planning, it is possible to use combinations of copying directories and compression files on one zip disk. Doing this, the same disk can be used for whole program backups as well as quick daily backups. Also, in an emergency, the data files can be used directly from the ZIP disk without being copied to the hard disk of a computer.
3. General Use – These disks are becoming generally used on many computers. They come both as internal and external disk drives. External drives work off parallel or USB ports and the newer ones don't require a separate power cord but get their power from the USB port of the computer. Thus, it is pretty easy to take a backup ZIP disk from one computer to another.
4. Cost – ZIP drives cost between \$100 - \$200 and the ZIP disks themselves are in the \$10 to \$25 range. Based on cost per unit of storage, if diskettes are 25¢ for 1.44 megs of storage, 250 megs of storage would cost \$43 using these. Using this logic, ZIP disks look like a great bargain.

Writeable CD's

Many computers have CD ROM drives that can write to a CD. Some CD's can be written one time (like those we use for updates) and others can be overwritten like other disks. These disks hold about 650 megabytes of data. That is the good part. The bad part is that when data is written to a CD, it becomes flagged "read-only", even when it gets copied back to a hard disk in a computer. Thus, to recover any data from them, one must understand how to copy files from the CD to the hard disk and then change file attributes. Also, the writeable CD's don't work in computers that don't have special programs to read them and they are somewhat slow to make. While these might be adequate for backing up some programs' data, they are not very good for cow data from DC305.

Summary for Backups

1. Backup frequently. When we're asked how often to do this, our standard response is, "As often as you don't want to re-enter data."
2. Use different disks. A minimum of 3 different daily backup disks should be used. Many backup to different disks on each day of the week. In this manner, if bad data is accidentally backed up, it is possible to go to one-day further back to get to good data.
3. Take data to a different building. Once a week or more often, data should be taken from the building where the computer is located to a separate building for safety (see Disaster Recovery section).
4. If something is wrong with the data or program, **DO NOT** backup that data onto one of your regular backup disks. The chances are very good you will be backing up bad data over good data.

Recovery for Historical Reasons

Generally, the need for this is to be able to re-create dairy records to what they looked like on a given date. We've seen this used for a variety of reasons. Sometimes people want to do research on such data or look at it to understand changes that have occurred over a period of time. Accountants sometimes need this data to match inventories, track growth, etc.

Many accounting programs have the ability to "turn back the clock" and look at "the books" as they stood on various dates. Dairy Comp 305 is not conducive to that method of record keeping. Bookkeeping systems are basically dated balance sheets. DC305 keeps track of ongoing cow activity. While historical data is kept on individual cows, the mix or relationships between different cows, such as average milk production on given dates, is not kept.

The best method of keeping this data is to backup to a disk and then don't overwrite it with new data. In other words, use one disk each time a date is to be preserved. Some write these disks monthly and some quarterly. A second method of keeping this data is to copy it to a separate portion of the hard disk. This can be a folder or compressed files that are stored by dates.

The variety of needs for this data is extensive and recovery methods vary greatly. If the data is kept, it can be recovered. For those who have this need, please give our support line a call if there are any questions about how to do this.

Backup for Disaster Recovery

There are all kinds of potential disasters that threaten your data. The most severe disaster is one that physically damages your computer such as a flood or fire or direct damage to the hard disk itself. Recovery of data in the absence of a backup in such situations can cost thousands of dollars, and, in many cases is not possible. Backup media for such a system must be stored off-site to be safe from the disaster. This doesn't happen very often, but when it does having a complete backup of your system is very helpful.

A more common disaster scenario is hardware damage induced by physical or electric shock, or minor exposure to liquid. In that case, the hard disk itself may be undamaged, and restoration may simply be an issue of replacing the damaged parts. If you can't wait for repair, you may need to use your backup media to restore your software and settings to a second computer until your first computer is up and running again.

The most common disaster is the software glitch. Software problems or bugs, viruses or faulty operating systems can all cause bad data to be written to the hard disk. The resulting damage may be as mild as a single scrambled file, or as severe as an operating system that no longer functions, preventing the computer from starting up. In these cases, a backup can sometimes be used to revive the computer to a functional state, restoring productivity until the problem can be diagnosed and fixed.

Here are some important considerations to think about when choosing a backup device and a backup strategy to protect yourself from disasters:

Frequency

To recover from a disaster you don't need whole system backups to be done very frequently. Program files don't change often so the real need for frequent backups is just data files. If a disaster strikes, if one can get the programs and system registries operational, then only the data files need to be brought up-to-date and all is back to normal. The key issue is to have a complete backup available, including the operating system and applications, so you can restore your system quickly. See the "Backup Medium Size" section that follows.

Reliability

Your backup medium only needs to be reliable during a span of months. If disaster recovery is your primary concern, you won't need to store backed-up files from years ago. All you're really concerned about is your most recent backup. However, if tape backups are used it is wise to check them periodically. We use tapes in our office and have found failures frequently when trying to read backup tapes. Newer systems seem to be better than those of 2 or 3 years ago.

Speed

To recover from a disaster, you have to backup and restore your entire storage subsystem. For today's computers with super-large hard disks, that's a time consuming prospect. Your backup device needs to be fast, so you will have the patience to make regular backups and so you can restore them promptly when they are needed.

Backup Medium Size

From a practical standpoint, total backup systems take on one of 3 or 4 forms. The most conventionally used method is tape backups. With bigger hard disks (80 gigabyte hard disks are commonly being sold today) tape drives have also grown in size. We see 20 gigabyte type systems selling for \$350 to \$750. Those that backup more (40 to 80 gig) are in the \$2000 to \$5000 range.

The second method used is a second computer connected via a network. While this setup offers a backup that is fast and easy, it doesn't have the ability to easily take the backup away from the building to a different location.

A third strategy used is to keep all installation program update disks and CD's. Then backup all data on disk (ZIP or others) and, in the event of a disaster, reinstall programs and put data back in. If all basic data is backed up and program disks are available, it is possible to buy a new computer and become functional in a short time if disaster strikes.

Other methods include combinations of the above along with data transfer to off-site locations. While data transfer is not practical for whole system backups, this does offer a possibility for active data backups, especially when the data files are not huge. See page 1 of this newsletter for a discussion of our off-site backup.

Whole data storage summary

Optimally, you would store your entire backup on a single storage medium (disk or tape). Doing this you could start your backup and walk away, confident that it will be complete when you return. Realistically, today's modern hard disks are so large that you'll have a hard time finding a backup medium that can store everything on a single tape, disk or cartridge. So usually you'll need to baby-sit the backup process and supply another backup volume when the first one is full. If your hard disk is really large, or your backup medium is small, you may have to make several swaps. If the process is too complicated or time-consuming, you'll have a hard time making regular backups. So pick the backup solution which has the largest media size you can afford or use the strategy of doing good data backups, keeping program disks and being able to jump into a new system – either your re-built one or a new computer – when the need arises.