REPRODUCTIVE PERFORMANCE ANALYSIS USING DC305

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Disclaimer: The following analysis guide represents some of the reports and set-up used by the Food Animal Production Medicine group at the University of Wisconsin-Madison. All of the reports are standard DC305 outputs, and more information about each can be obtained using the DC305 help manual.

Basic Information

Computer based fertility record systems require some basic event information to produce action lists for herd management and monitors of herd reproductive progress. These events include:

FRESH  Calving event, but not ready to breed
HEAT   Heat event
BRED   Service / Breeding events. Enter sire and technician ids
PREG   Pregnancy event
OPEN   Open event
DRY    Dry off event
OK     OK to breed event
ABORT  Abort event. If days carried calf (DCC) is >152, new lactation starts. If DCC<152 the cow remains in her current lactation and repro status is requested: RC=2 Fresh, 3 OK or 4 Bred.
DNB    Do not breed event.

Basic Reproductive Indices

Run the command:

```
SUM DIM DOPN BRED1 TBRD FOR LACT>0
```

This will give the number of cows in the herd, the average DIM, DOPN, BRED1 and TBRD for all cows. If you add RC=5-6 to the FOR command you will see the averages for only pregnant cows. Note the difference!

You will need the following items – which are usually already present in the system:

**BRED1 (1BRED, DT1B, DIMFB)**
- type: 71 dim up to event
- event: BRED
- which event: 1 (first)
- description: dim up to bred1

**DOPN**
- type: 49 date minus date
- event1: CDAT
event2: FDAT
description: days from calving to conception

CDAT
type: 18 dates
description: conception date if pregnant

TBRD
type: 1  0 - 255
description: times bred

Does the herd need to improve fertility? What are the targets for BRED1, average DIM and DOPN? How useful are these measures in small and large herds?

Data Check

A number of reports can be run to check data for inconsistencies and herd performance.

GRAPH MILK BY DIM TBRD FOR RC=2-3 DIM>59

This graph allows us to examine the herd for breeding efficiency, distribution of DNBs, and the performance of high production cows.

LIST ID PEN DSLH FOR LACT>0 RC=4 DSLH>30 DOWNBY DSLH\PU

Creates a list of cows >30days since last breeding that have not been re-bred. Individual cow cards may be viewed off this list to determine the history of breeding.
Examination of the Voluntary Waiting Period (VWP) and timing of first breeding

Rather than ask the herd owner what the VWP is, we can examine the operating definition using a scatterplot of bred1 against current DIM. This graph can be used to indicate what kind of breeding program is being used and to determine whether there are parity differences.

GRAPH BRED1 BY DIM LCTGP

Notice that there are two main periods of insemination in herd X, a small scatter at around 65DIM and then a large mass of breedings at 72 to 81 DIM. This herd uses a Pre-Synch program heavily, but continues to breed a few cows after the second prostaglandin shot. The early breedings <20DIM are predominantly cows that aborted. Sorting by lactation group allows us to determine whether there are parity differences in VWP. For this herd, we could enter the VWP as 60 days.

As a rule of thumb, enter the DIM at first breeding above which 95% of cows are bred as the VWP.

In contrast, look at the plot for another herd, herd Z - which uses heat detection followed by ovsynch at 55 DIM if cows have not been bred. The herd achieves the same average days to first breeding as the herd above, but the distribution is very different – which is better, herd X or herd Z?
An alternative way to examine the same data is to create a histogram of bred1 using the command:

```
GRAPH BRED1 FOR BRED1>0 LACT>0 \H
```

This is the histogram for herd X – showing the tightly synchronized first breeding window, and the small number of early breedings.

DC305 now has alternatives for creating the scatter and histogram plots of Bred1. For example;

```
GRAPH BRED BY DIM\SN1
```
-delivers the scatterplot (\S) of the first breeding DIM (switch N1). Switch N2 would give the plot of the second breeding etc.

**GRAPH BRED BY DIM\W1N1**

-delivers the histogram (\W1) in one day increments for bred1.

The switch \D will give you the ability to lock in a DIM range – for example /D90 will only look at breedings in the last 90 days.

What proportion of cows should receive their first breeding by a certain DIM threshold?

For herds that are bred solely through TAI, then we would like to see >90% of cows bred by 7 days (if weekly synch program, 14 if every 2 weeks) + DIM range for first breeding eg 70-77, ie 77+7=84 DIM.

For herds using a combination of estrus detection and TAI, then the target is to see >90% of cows bred by VWP + 30 days. Try the command: **PCT DIMFB=51-81 FOR FDAT>-400 DIM>81 ABDAT=0\L**

Both targets exclude cows that are labeled DNB and cows that have aborted and started new lactations.

Once the VWP has been determined, analysis can proceed using the bredsum function.
The BREDSUM Command

Basic analysis of fertility can be performed using the BREDSUM command. Before running any other commands, run the `BREDSUM\V` command and enter the herd voluntary waiting period. The default is 50.

If a particular date range is to be examined, use the command `BREDSUM\D` to select the dates. If you wish to select a population or pen group use the FOR statement. The data are presented for the past 365 days for all cows including dead cows unless otherwise specified.

Survival Curve Analysis

The key to good reproductive performance is to recruit animals for breeding quickly and efficiently once they have reached the end of their VWP (service rate or submission rate) and to achieve good conception rates once bred. The monitor for the efficiency of this program is the proportion of cows that are pregnant by some time period after calving. We can look at this using the command:

```
BREDSUM\ERV60
```

- V60 refers to the length of the VWP, E gives us a 21 day heat trial and R gives us the 21 day heat trial by DIM starting at the VWP. Look at both the report and the graph for this command. Note that these data are only for cows that are pregnant!

Herd X above achieves a very high insemination risk (% eligible cows inseminated within 21 day period) for first breeding with its pre-synch program, with >35% pregnancy rate. However, there is relatively poor insemination risk after the first breeding, until the cows are pregnancy checked and re-synchronized if open.

Targets to look at on the graph are:

More than 50% of the cows pregnant by 100 DIM
More than 70% of the cows pregnant by 150 DIM
More than 90% of the cows pregnant by 300 DIM

Run the graph again for more recent calvings - say the last 6 months, by adding `d` to the switch and entering the date selection. Are things better or worse more recently?

Herd W shown above is a small tiestall herd. Notice the alternating high and low peaks of service rate and pregnancy rate. This is a classical response to a herd that uses Ov-Synch and TAI only. After first breeding, they wait for preg check. Open cows are given Ov-Synch and bred. These cows are preg checked and again open cows are given Ov-Synch. With a relatively low conception rate this herd does not meet the suggested targets above.

This analysis suffers from time lag, so the next step of the evaluation is to look at the effect of time on reproductive performance.

**BREDSUM\E**

This is the 21 day heat trial and incorporates use of the pregnancy rate monitor used by DC305. The breeding results are ordered in 21 day intervals back in time. The Br Elig column gives the number of cows that were eligible to breed (over the VWP and not pregnant) within each 21 day window. Bred is the number that were actually bred and Pct is the insemination risk. Target insemination risk using this formula is >60%.

Pg Elig lists the number of cows that are eligible to become pregnant within each 21 day window. It is usually similar to or exactly the same as the number in the Br Elig column, but excludes cows that have been sold before being diagnosed pregnant. The Preg column is the number diagnosed pregnant and Pct is the pregnancy rate. Target pregnancy rate is >20% and average performance is around 15%.

Conception risk is not recorded, but is approximately equal to the number in the Preg column divided by the number in the Bred column.
The Aborts column is a new addition and counts the pregnancies that have been lost over time. This is different to the ABORT event as it also counts early embryonic death.

The command BREDSUM\EAV60 also delivers a graph, as well as the table above in the report tab.

Switch A uses all breedings (both TAI and natural) whereas the default is only TAI. Adding D700 allows us to look at 2 years worth of data if the archive file is accessible. Variation in insemination risk and pregnancy rate over time can be evaluated from this graph.
**Conception Risk Trends**

Defined as the proportion of services with known outcomes over a specified period of time that result in a pregnancy.

Variation in breeding outcomes over time can be evaluated using the command:

```
GRAPH BRED \R
```

Clicking on the color code in the legend will allow you to switch off certain choices (eg. open) and track conception risk, abortion and pregnancy over time.

**Parity Effects**

An examination of conception risk by parity groups can give us an idea of how well the first lactation heifers are performing and how well mature cows are performing in comparison. In this case, we are really using the L1 cows as controls for comparison of the rest of the herd. We would expect to see a conception risk of >40% for heifers (L0), >35% for L1, >33% for L2 and >30% for L3+.

```
BREDSUM BY LCTGP
```
Is there a conception risk (%Conc) problem? SPC is services per conception. Read the TOTALS line for the herd average. What factors influence conception rate on a farm? How would you go about investigating it?

**Interval Analysis**

This analysis looks at breeding performance AFTER first breeding. This is a common problem in herds that rely too heavily on TAI programs. How well do cows get examined for heat once they are bred?

**BREDSUM**

The report page for this command also gives averages for days to first breeding, days to conception and calving interval.

The %Tot column of the table gives the distribution of repeat breedings for intervals 0-3, 4-17, 18-24, 25-35, 36-48 and over 48 days. Remember that the average heat cycle in high producing dairy cows is typically 23 days with a range from 18 to 27 days. Use these data to examine heat detection accuracy and heat detection efficiency.

Accurate heat detection means that cows are being bred when they are actually in heat. Accuracy should be 90% or greater and herds that breed a high percentage of cows that are truly in heat typically have fewer than 8% of the total number of repeat breedings at 4-17 days. It is common to find 12% or more of repeat breedings within this window. Look at the conception risk (%Conc) to these breedings … you may be surprised to find that it is quite good. Why?

The answer is probably related to cows showing secondary signs of heat at the peak of the second follicular wave mid-cycle. These cows may be bred at this time, but then show strong signs of heat 10-14 days later, at the true heat. Obviously these cows should be bred at this time – which leads to a short interval breeding, but a successful one!
In herds with a high rate of short interval breedings, it would be advisable to implement a system of coding the breeding at the time of data entry – standing heat, secondary heat, TAI etc. That way, you can examine the success rate of breedings based on secondary signs. They may also be useful to the herdsman. If a cow is in heat 10-14 days after breeding, and the last breeding was based on secondary signs, they should breed the cow. If the last heat was based on standing heat, they should ignore the cow if she is only showing secondary signs.

Excellent heat detection rate will result in >50% of repeat breedings at 18-24 days. This is rarely achieved where herds do not practice aggressive heat detection practices (tail chalking, etc). In order to achieve high rates at 18-24 days, some herds may do so at the expense of more short interval breedings (as discussed above). This may well be worth it! Large numbers of repeat breedings at 25-35 days may be driven by the reproductive program (early scan and PG or re-synch programs), or may result from early embryonic death – always check the reproductive management program before over interpreting this number. More than 15% of repeat breedings >48 days suggest that multiple heats are being missed after breeding and that there is over reliance on pregnancy check results followed by estrus synchronization and timed AI.

Conception rate may be examined in a variety of different ways using the bredsum command with the following switch keys:

- **BREDSUM\O** by breeding codes
- **BREDSUM\B** by breeding number
- **BREDSUM\C** by calendar month
- **BREDSUM\N** by cycle number
- **BREDSUM\T** by technician
- **BREDSUM\S** by sire
- **BREDSUM\W** by day of the week
- **BREDSUM\E** by 21 day heat trial

**BREDSUM\O**

Conception rate by breeding code eg standing heat v TAI should be within 2% of each other. In some herds, Ov-Synch or similar may be used on only problem cows – so check the breeding program before interpreting.
Look for trends across first, second and third breeding. Poor performance at first breeding, with good performance subsequently may indicate issues related to cow health in early lactation and a poor transition. Performance over the first 3 or 4 breedings should be within 2% of each other.

It is very common to see poor performance during the typical heat stress period – July-September. Feeding issues may also show up in some months, although this is best examined using a cohort analysis (see later).

Look to see if cows are being bred too early – conception rate may be a few % points lower. Typically conception rate is fairly constant over the range of cycles.

Examine technician performance. Make sure you look at the %Tot column first – to make sure that someone is being judged fairly. Also check to make sure that one breeder doesn’t only get to breed the ‘difficult cows’! If problems are seen, this is an issue for the management group to deal with. Do not single the individual out – if re-training is required, re-train everyone!

Add a 3 to the switch to restrict the analysis to sires with a minimum of 3% of the breedings in a herd. Are there any sires that stand out with very poor conception rates?

In bull bred herds, this looks at a 21 day pregnancy rate starting when the cow enters the bullpen (if correctly coded) using \UR or by date using \R.

Check the performance of the weekend crew. You should be able to see which day the TAI is carried out on as well.

By using the switch \X, followed by 2 of the above options, combinations of breeding events can be examined.

The most useful example of this option is:

BREDSUM\XOT
This creates an analysis of conception risk by breeding code and technician.

Conception risk is given by inseminator and breeding code, along with mean, range, percent of all breedings and 95% CI. This allows us to fairly judge whether one inseminator is statistically worse than another without the issue of whether one person is only breeding the difficult cows.

Other switch options include:

**BREDSUM\XBO**

Breeding number by breeding code allows us to see which breedings are using which synch program.

**BREDSUM\XRO**

Breeding date by breeding code allows us to see which breeding program is being used over time.

**BREDSUM\XRB**

Conception risk by breeding number over time.

**Cohort Analysis**

It is sometimes beneficial to look at the performance of cohorts of animals over time. Typically we can look at calving month groups – and follow their performance through to the most recent date.

DC305 can do this using an item called STAGE (if the item already exists, check that it is set up as follows):

**STAGE**
type: 108 item/x
item name: DIM
operand #2: 30
BREDSUM BY STAGE FOR LACT>0

- Command : BREDSUM BY STAGE FOR LACT>0
Summarized by STAGE from 3/1/04 through 3/1/05

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</table>

2 non-AI breedings were omitted

The STAGE groups from 1 through to x refer to 30 day calving groups going back in time. They are presented for all of the cows currently milking in the herd. Cohort analysis is particularly sensitive for picking up nutritional effects on fertility – as these effects, if they occur in early lactation, often stay with the animal throughout its breeding history. Note the difference in conception rate for STAGE 8 and STAGE 7 in the table above for a small 50 cow dairy.

**Twinning and Calf Mortality**

Use the EVENTS command and select the Calf Table.

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<th>Female</th>
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TOTAL 1541 12 81 5 883 727 45 1456 154 10 103 12 51 7
The twinning rate for the last year will be given, along with mortality rates for heifer and bull calves. Twinning rate should be no higher than 6%.

If more than 10% of heifers are dying, delivery practices will need to be reviewed.

**Rate of Pregnancies per Month**

Pregnancies required per month can be calculated as follows:

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<th>Description</th>
<th>Value</th>
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</thead>
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</tr>
<tr>
<td>Removals for culling reasons</td>
<td>-530 (0.37 herd size)</td>
</tr>
<tr>
<td>Requirements due to pregnancy loss</td>
<td>+135 (0.15 pregnancies)</td>
</tr>
<tr>
<td>Total pregnancies required per year</td>
<td>1037</td>
</tr>
<tr>
<td>Calving Interval desired (months)</td>
<td>13</td>
</tr>
<tr>
<td>Pregnancies required per month</td>
<td>80</td>
</tr>
</tbody>
</table>

Find the total number of pregnancies produced for the herd from bredsum by lctgp'd for the last year and calculate the pregnancies created per month and compare with the calculated target.

A calculation of the required % cows pregnant per month is a useful herd level monitor of reproductive performance. Typical range is 4 to 10% annual average.

Example:

# preg = 1198
Divided by 12 months = 100 pregnancies per month being created currently
Find out the number of milking cows in the herd (typically 85% of the herd total) = 1217
% cows made pregnant each month is 100/1217 x 100 = 8.2%

**Palpation Pregnancy Rate**

# pregnant / # examined for pregnancy x 100

The palpation pregnancy rate can easily be calculated and gives some idea of heat detection rate in the herd. In herds with high rates, the effect of estrus synchronization programs is probably not worth it. In herds with low rates, synchronization programs should be seriously considered. Dependent on the time after breeding when pregnancy check occurs, rates of >70% would be considered good.

**Pregnancy Check Schedule**

Monitor the schedule for preg checks in the herd by using the graph:

GRAPH PREG BY DSLH\N1
Preg checks are occurring as early as day 28 and as late as 46, with most occurring at 32 days. This herd is using ultrasound at weekly intervals.

**Cost of a day open**

So what is the cost of a day open?

Despite the use of BST and the increased persistency of lactations, it would still appear that the optimum DOPN is 110 days. With increased persistency, losses will be incurred in cows that get pregnant too quickly, but losses also become particularly severe after day 150. The figure below gives an estimate of the cost of a day open by days open (Meadows et al., JDS 88:1244, 2005).

The goal for herd reproductive performance is therefore to organize breeding effectively and efficiently and to achieve a high conception rate once the animals are bred – so that the range in DOPN is as small as possible. Although submitting cows efficiently for breeding is important, without a high conception rate, we cannot limit the losses from increased days open at a herd level.