

**A high rate of heat detection is critical to achieving good fertility performance in the dairy herd, particularly when artificial insemination is being used. Heat detection efficiency can be assessed by calculating the submission rate for your herd. This is the proportion of cows eligible for breeding that are served bred over a specific period of time.**

**The aim of this Challenge Note is to describe how to calculate the submission rate of your herd using a simple paper-based record system.**

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### **Why Measure Submission Rate?**

To achieve a 365-day calving index, cows need to be served and back in-calf again within 85 days of calving. However, research findings from the Agricultural Research Institute at Hillsborough have found that the average interval to first service is 85 days with an average conception rate of 40% making a 365-day calving index impossible to achieve. One of the most important factors affecting interval to first service and overall fertility performance is submission rate that is the proportion of eligible cows served during a specific period.

### **What Cows are Eligible?**

In Northern Ireland dairy herds with a spread calving pattern, there are essentially two factors that determine the number of cows eligible for breeding:

- Start of breeding season;
- Voluntary waiting period (VWP).

Most farmers take a break from breeding cows for a few months during the year. In spread winter calving herds breeding starts again at around the same date each year, for example 1 December, 1 January. Voluntary waiting period is the second factor affecting a cow's eligibility for service.

Most farmers do not serve a cow until she is at least six weeks calved, or possibly longer in higher yielding herds. This period allows uterine involution (repair of the reproductive organs post-calving) to take place (see Challenge Note 4C: **Management of the Dairy Cow Around Calving**). This period is known as the voluntary waiting period (VWP) and cows become eligible for breeding after this period of time.

## Factors Affecting Submission Rate

Good heat detection efficiency is the key to achieving a high submission rate, although research evidence suggests that cows now have shorter and less obvious signs of heat, making heat detection more difficult. Other cows may be anoestrus and have no regular oestrous cycles or show signs of heat (see Challenge Note 4D: **The Problem Cow After Calving**).

These are not the only factors affecting submission rate. Some cows, particularly those producing a lot of milk may be seen on heat and not served for management reasons. For this reason, it is important to take care when establishing the voluntary waiting period for your herd.

## How can Submission Rate be Measured?

Some computer recording packages can measure submission rate, but it can also be measured using a well laid out paper-based record system as early as three weeks from the start of the breeding season. A good paper-based recording system has been developed for the *Dairy Herd Fertility Challenge* and allows simple calculations such as submission rate to be conducted. In Northern Ireland, dairy herds generally fall into three categories according to their calving pattern as indicated below, but submission rate is measured essentially the same way:

- **Seasonal** - calving over a 2-4 month period;
- **Spread** - calving over a 4-8 month period;
- **Year round** - calving over an 8-12 month period.

## How do I Measure the Submission Rate of my Herd?

$$\text{SR\%} = \frac{\text{Number of cows served during specific period} \times 100}{\text{Number of eligible cows}}$$

As indicated earlier, submission rate is the proportion of cows served during a specific period. This period is usually three weeks to correspond with the length of the cows oestrous cycle. Only cows eligible for breeding are included on the bottom line of the equation that is only those:

- intended for re-breeding;
- that have passed their VWP.

COW	CALVED	PREBREEDING HEAT1	HEAT2	SERVE1	SERVE2	SERVE3	SERVE4	SERVE5
158	4-Oct	16-Dec		7-Jan	27-Jan	15-Feb	10-Mar	
150	5-Oct			1-Jan	20-Jan			
132	9-Oct			9-Jan				
97	11-Oct			14-Feb	7-Mar	27-Mar		
23	18-Oct	5-Dec	26-Dec	17-Jan	7-Feb			
79	19-Oct			5-Jan	16-Feb			
48	21-Oct	26-Dec		16-Jan				
41	23-Oct	Not for serving						
85	30-Oct			19-Jan	9-Feb			
104	31-Oct							
14	2-Nov	11-Dec		2-Jan				
169	9-Nov	Not for serving						
75	11-Nov			14-Jan				
100	16-Nov			15-Mar				
24	18-Nov			7-Feb				
135	21-Nov			7-Mar	29-Mar			
<b>Period</b>	<b>Calved on/before</b>	<b>End of period</b>	<b>No. eligible for service</b>	<b>No. cows served</b>		<b>SR%</b>		
1	20-Nov	21-Jan	13	9		69%		

### 4. Simple calculation:

$$\frac{\text{No. cows served}}{\text{No. cows eligible}} \times 100$$

1. If breeding starts on 1<sup>st</sup> Jan and VWP is 42 days, cows are eligible if calved on/before 20<sup>th</sup> Nov.

2. Each 3-week period lasts 21 days – the first period of breeding season ends 21<sup>st</sup> January.

3. Count of number of cows eligible and number of cows served in first 3 weeks.

**Figure 1:**

Calculation of submission rate in the first three week period of the breeding season.

Irrespective of calving pattern, the breeding season is divided up into three week breeding periods, with seasonal calving herds having a small number of breeding periods and year round herds having many more. An example of how to calculate the submission rate in the first three week period from a paper-based recording system is given in Figure 1, based on a 42-day VWP and breeding starting on 1 January.

### Seasonal Calving Herds

In seasonal calving herds a large proportion of cows have completed their VWP by the start of the breeding season and are eligible for breeding right away. In very tight seasonal calving herds, especially those that are spring calving, the voluntary waiting period may be very short with cows eligible for re-breeding as soon as they calve.

### Spread Calving Herds

The majority of dairy herds in Northern Ireland have a spread calving pattern with early calving cows (and carry-over cows from the previous season) being eligible for breeding before the last cows have calved. As a result, the breeding season is also prolonged, with more three week breeding periods than a seasonal calving herd. In the first three week period, only cows intended for rebreeding that have calved longer than the VWP are counted. If the breeding season begins on 1 January and the voluntary waiting period is 42 days, only cows that calved on or before 20 November are eligible for breeding - this date can be calculated by counting back six weeks in a diary or calendar, or by looking at the table 'Submission for Breeding' in the *Dairy Herd Fertility Challenge* breeding records. The submission rate for the first three week period is based on the number of eligible cows served during the first 21 days (that is cows served up to 21 January in the Figure 1 example).

Later calving cows are divided into three week blocks based on their calving date and fit into subsequent breeding periods. For each new period, 21 days should be added to the second and third column of the submission rate table (see Table 1) and the number of cows eligible for breeding in each block counted. The overall submission rate for the season is based on the entire breeding season, although the higher numbers in the early part of the season will have greatest impact.

**Note:** a cow might not be eligible for service until period 2, but can be served during period 1. However, her service only counts towards the submission rate in the period that she is eligible for breeding (period 2).

**Table 1:** Example of how to calculate the submission rate to first service in successive three week periods throughout the breeding season, operating a 42-day VWP and beginning to serve on 1 January.

Period	Calved on/before	End of breeding period	Total no. cows calved	No. cows for rebreeding	No. cows served before end of period	SR%
1	20 Nov	21 Jan	15	13	9	69
2	11 Dec	11 Feb	5	5	2	40
3	1 Jan	4 Mar	4	3	3	100
4	22 Jan	25 Mar	5	5	2	40
5	12 Feb	15 Apr	7	6	3	50
6	5 Mar	6 May	3	3	2	67
7	26 Mar	27 May	5	5	2	40
8	16 Apr	17 Jun	5	4	3	75
9	7 May	8 Jul	1	0	-	-
<b>Overall</b>			<b>50</b>	<b>44</b>	<b>26</b>	<b>59%</b>

## Year-round Calving Herds

These herds generally calve cows more than eight months of the year, but in most herds there is a slack time when fewer cows calve. Therefore for the calculation of submission rate, a suitable breeding start date should be established to correspond with this.

## Target Submission Rates

Target submission rates vary according to calving pattern. In seasonal calving herds, maintenance of compact calving is very important so these herds have fewer breeding periods and a higher submission rate target for each period than spread or year-round calving herds (see Table 2).

It is possible to achieve a high submission rate and reach the target set for your type of herd by using a high voluntary waiting period in your calculation (for example 70 days or more). While this approach may give the impression of achieving targets, it can be detrimental to overall fertility performance as measured by 100-day in-calf rate or 400-day re-appearance rate (see Challenge Note 1B: **Evaluating Fertility Performance**).

**Table 2:** Target submission rates for each three-week period in dairy herds with varying calving patterns.

Calving pattern	Target submission rate
Seasonal calving	85% in each 3-week period
Spread calving	80% in each 3-week period
Year-round	75% in each 3-week period

## Summary

- Submission rate is the proportion of cows eligible for service and intended for rebreeding that have been seen on heat and served within a given period of time.
- Having a high submission rate is a key element of good fertility performance.
- Good heat detection and service of cows seen on heat is required to achieve a high submission rate.
- The submission rate of your herd can be calculated using a good paper-based herd recording system throughout the breeding season.
- Before calculation, you need to establish your voluntary waiting period and the start date of your breeding season.
- Submission rate is measured in three week periods and can be monitored throughout the entire breeding season.
- Target submission rates vary with calving pattern.