

# Economic aspects of dry cow therapy

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**D**ry cow therapy has been part of mastitis control since the 1970s and has been one point of the five point scheme. In many countries many, if not most, dairy farmers apply dry cow therapy as part of their farm specific mastitis control plan.

The general advice in the five point plan is that all cows, at drying off, should be treated with a specific long acting antibiotic formulation – the blanket method.

The effectiveness of dry cow therapy is attained in two ways:

1) By treating existing infections at the moment of drying off by means of long-acting antibiotics.

1) By treating possible infections during the dry period. Since not all cows have an intramammary infection (IMI) at the onset of the dry period, a certain percentage of IMI at the onset of the dry

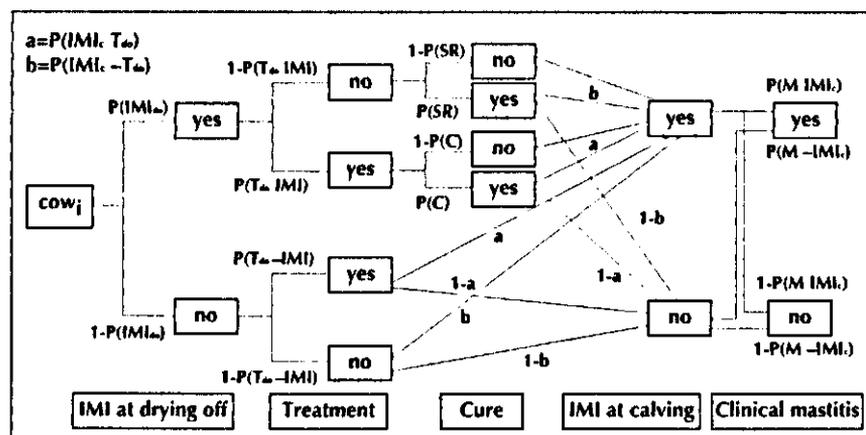


Fig. 1. Graphical representation of the stochastic model to estimate the costs and benefits of dry cow therapy.

cow period will cure spontaneously, and since not all cows will become infected during the dry cow period, many cows

are treated unnecessarily. This means that part of the dry cow treatments are not necessary and thus impose an economic loss. Moreover, in certain countries (for example the Scandinavian countries) because of the risk of human resistance against antibiotics there is a tendency to only use dry cow therapy for those cows needing it. This means that besides no and blanket dry cow therapy, there is a third option: selective dry cow therapy.

For the dairy farmer, economics are a major incentive to apply dry cow therapy or not. However, there is not much data available about the cost effectiveness of dry cow therapy. One study from the beginning of the 1990s showed that blanket dry cow therapy in Canadian circumstances was economically beneficial compared to no dry cow therapy.

However, there was much variation in this study and selective dry cow therapy was not taken into consideration. Further research on the economics of dry cow therapy can help to clarify the discussions on dry cow therapy.

The goal of this article is to explore the economic aspects of dry cow therapy and give some insight in the mechanisms behind costs and benefits of dry cow therapy.

To get more insight in the economic aspects around dry cow therapy a stochastic Monte Carlo model has been developed. The basic unit of the model is a cow. At drying off a cow can have an IMI or not. Each cow can be treated.

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Table 1. Parameter explanation and default values of the simulation model for dry cow therapy.

Parameter	Explanation	Default
$P(\text{IMI}_{\text{d}})$	Probability of IMI at drying off	0.15
$P(T_0, \text{IMI})$	Probability that a cow will be treated at drying off, given the fact that the cow has an IMI. When selective dry cow therapy is applied, this is equal to the sensitivity of the test used to determine cows with IMI	Sensitivity: 0.95 <sup>1</sup>
$P(T_0, -\text{IMI})$	Probability that a cow will be treated at drying off, given the fact that the cow has no IMI. When selective dry cow therapy is applied, this is equal to 1-specificity of the test used to determine cows with IMI	Specificity: 0.60 <sup>1</sup>
$P(\text{SR})$	The probability that IMI at drying off will cure spontaneously	0.30
$P(\text{C})$	The probability that IMI at drying off will cure as result of treatment	0.75
$P(\text{IMI}, T_0)$	Probability of IMI at calving, when there was no, or a cured IMI at drying off, given that the cow was treated at drying off	0.25
$P(\text{IMI}, -T_0)$	Probability of IMI at calving, when there was no or a cured IMI at drying off, given that the cow was not treated at drying off	0.10
$P(\text{M IMI})$	Probability of clinical mastitis after calving, given that the cow had an IMI at calving	0.45
$P(\text{M -IMI})$	Probability of clinical mastitis after calving, given that the cow had no IMI at calving	0 <sup>2</sup>

<sup>1</sup>When no or blanket dry cow therapy is applied, these probabilities are respectively 0 or 1. No literature data were available on sensitivity and specificity of selection procedures for selective dry cow therapy, so a rough estimation has been made, based upon experience.

<sup>2</sup>No literature data available.

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Probabilities that an IMI will cure depend on treatment. If an IMI at drying off remains persistent, the cow will have IMI at calving. If the initial IMI is cured, or if the cow did not have an IMI at drying off, there is a probability that the cow will have an IMI at calving.

This probability is dependent on treatment. The model has been graphically represented in Fig. 1.

Descriptions and default values of the model parameters are given in Table 1. The default values have been estimated as good as possible based on a number of recent publications with regard to dry cow therapy. Some of the parameters are

	None	Dry cow therapy Blanket	Selective
<b>Probabilities</b>			
IMI at drying off (%)	15.5	14.6	15.6
Treatment at drying off (%)	0.0	100.0	48.9
Non cured IMI (%)	10.8	3.4	4.4
New IMI in dry period (%)	24.8	10.2	17.1
IMI at calving (%)	32.9	13.3	21.0
Mastitis after calving (%)	15.1	5.7	9.4
<b>Costs</b>			
Total costs ( )	47	25	33

Table 2. Simulated dynamics of infections and total costs (/cow) for default situation.

associated with costs. When selective dry cow therapy is applied, there might be costs of selection of cows. In the

basic situation, it is assumed that this is done using records with regard to clinical mastitis and cow somatic cell counts (no additional bacteriological examinations).

Therefore, the costs of selecting cows will not be high and the default value of this parameter will be 0. When applying bacteriological examinations for instance, the performance of selection (sensitivity and specificity) will increase, but also the costs of selection will increase.

Costs for treatment have been set for €8.0 (at the moment of writing €1.0 = \$US 1.0) per cow (4 injectors). These are approximately the costs for common dry cow antibiotics in the Netherlands.

When there is an IMI during the dry period, either a non-cured IMI at the beginning of the dry period or a new IMI during the dry period, there will most probably be an effect on the milk production in the following lactation. This effect is assumed to be a decrease of 5% in milk yield.

The basic milk yield in the model is 8.5kg per cow per lactation, which is approximately equal to the Dutch herd book average milk yield in 2001.

Costs of a decrease in milk yield is set to €0.08 per kg and are based on the additional costs of the extra cows necessary to fill the milk quatum when the milk yield of cows is lower.

It is assumed that the milk quatum will be filled.

Finally, the cost of clinical mastitis in the first part of lactation is assumed to be €277.0. The costs of clinical mastitis consists of treatment, lower milk production throughout the lactation, discarding of milk and a higher probability of culling and are calculated for an average mastitis case, given the distribution of pathogens for the Dutch circumstances.

When there is a clinical mastitis at calving, the milk yield decrease caused by IMI during the dry period will be set to zero (5%) to prevent additive effects.

By adding random factors in the model (stochastic modelling), real life situations can be simulated. For example, random numbers drawn by the computer determine if a cow has IMI at drying off,

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**Study: Differences in probabilities compared to default situation**

<b>Berry and Hillerton (2002)</b>	<b>Østerås et al (1991, 1994)</b>
New IMI dry period: 0.29	Spontaneous cure of IMI: 0.37
New IMI dry period with treatment: 0.06	Cure IMI after treatment: 0.65
	New IMI dry period: 0.2
	New IMI dry period with treatment: 0.15

	Dry cow therapy		Dry cow therapy	
	Blanket	Selective	Blanket	Selective
<b>Probabilities</b>				
IMI at drying off (%)	14.8	15.5	14.8	15.3
Treatment at drying off (%)	100.0	48.4	100.0	48.7
Non cured IMI (%)	3.7	4.3	5.3	5.6
New IMI in dry period (%)	5.7	17.9	14.8	17.0
IMI at calving (%)	9.2	21.8	19.2	21.7
Mastitis after calving (%)	20	9.7	8.6	10.0
<b>Costs</b>				
Total costs (€)	20	34	34	35

**Table 3. Simulated dynamics of infections and total costs (/cow) for two specific situation as described in literature.**

whether the cow is selected to get dry cow therapy (in case of selective dry cow therapy), whether this cow is cured, and whether a cow gets mastitis at calving. This means that coincidence plays an important role, just as in real life.

When the model is run for a large number of cows, the average of all cows will approximate the average research data.

However, when the model is run for a small number of cows (for instance the number of cows of one farm), the average for these cows (this farm) may vary largely, depending on coincidence.

**Simulation results**

In this preliminary study, the basic situation, with no dry cow therapy, blanket dry cow therapy and selective dry cow therapy has been simulated for 10,000 cows per simulation (Table 2).

When comparing no dry cow therapy with blanket dry cow therapy, it can be noticed that treatment has an effect on the dynamics of IMI during the dry period (Table 2).

With treatment there was a lower percentage of non-cured IMI, less new IMI in the dry period and, therefore, less IMI at calving, resulting in less clinical mastitis. When selective therapy was applied, under the current assumptions, the number of non-cured IMI was only slightly higher than under a blanket dry cow therapy protocol.

However, there was more new IMI during the dry period, resulting in more IMI at calving and thus more mastitis. The total costs (treatments, milk production losses and clinical mastitis) under the default situation were lowest for blanket dry cow therapy (€25) per cow per lactation, while the costs for no dry cow

therapy were highest (€47) per cow per lactation).

In Fig. 2, it can be noticed that costs of clinical mastitis is the largest proportion for all situations. While with selective dry cow therapy, the costs of treatment per cow are reduced with more than 50% compared to blanket dry cow therapy (€3.20 vs €7.56 per cow per lactation).

When running the model for a number of cows on a farm (100 cows per farm), the results may differ very much per run. For instance, the total costs of IMI during the dry period (including costs of treatment) varied from €10.67 to €44.88 per cow per year for the default situation, applying blanket dry cow therapy.

The default situation is estimated based on a number of scientific publications and is some kind of average. However, dynamics of IMI during the dry period may vary to a large extent.

The model has also been run for the situation as is specifically described by Berry and Hillerton (2002) and by Østerås et al (1991, 1994).

Both studies differ in design and selection criteria which may have effects on outcome. The differences of the studies, compared to the default situation (as could be determined from the papers) and the results of the simulation are given in Table 3.

The study of Berry and Hillerton (2002) showed a larger proportion of new IMI during the dry period and also a larger effect of treatment on the prevention of IMI during the dry period. The study of Østerås et al (1991, 1994), showed a larger spontaneous cure and a lower cure as result of treatment.

Moreover, the effect of treatment on new IMI during the dry period was also

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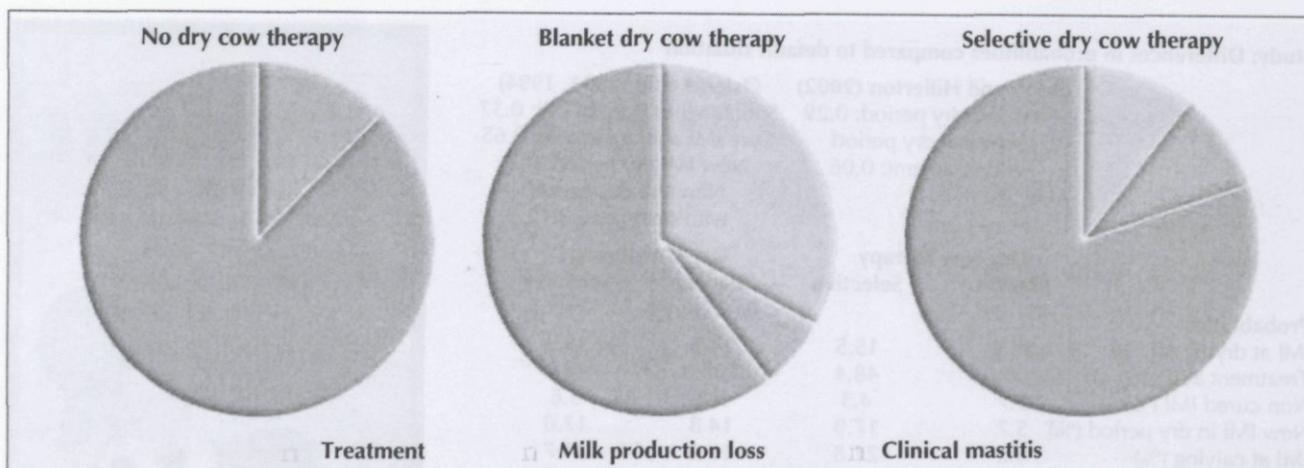


Fig. 2. Losses (per cow per lactation) associated with dry cow therapy as a result of the simulation model with default values.

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lower. The differences between both studies reflect in the losses associated with IMI in the dry period. In the study of Berry and Hillerton (2002), the difference between selective and blanket dry cow therapy increased, while in the study of Østerås et al (1991, 1994), the difference reduced to almost zero (see Table 3).

The model presented in this article is only a simple model. This means that many effects have not been accounted for. For instance, the cost of clinical mastitis has been a fixed amount, calculated for Dutch circumstances. Occurrence and additional effects of clinical mastitis during the dry period have not been taken into account.

There are differences in economic effects between high producing and low producing cows. Because of the type of breed (milk type vs dual purpose type) and the meat price in a country, costs for culling cows may differ very much between countries.

The value of a lower milk yield has been set to €0.08 per kg. This is low, compared to the milk price of approximately €0.32.

However, the value of a lower milk yield differs from a quota (Europe and Canada) to a non-quota (USA, New Zealand and Australia) situation. Even within Europe the value of a higher milk yield per cow differ because of regional price differences.

Moreover, costs of labour have not been taken into account. Besides direct associated costs (a fixed amount per hour), some types of labour have a high emotional cost. For instance types of labour that are not liked and which are associated with problems.

These values may differ between countries or regions. Probabilities of IMI during, at drying off or during the dry period may also differ between regions and even between farms, since they might be

dependent on the mastitis control management applied on the farm.

It would be good for the discussions regarding dry cow therapy that the model would be extended and fed with data from various regions.

These data should be the physiological data regarding probabilities of IMI at drying off and during the dry period, but also the costs associated with them.

This study has only given the factors of

importance when discussing the economic effectiveness of dry cow therapy.

The presented model needs to be extended to represent the real physiology of dry cow therapy in a more precise manner.

Using specific input from a certain country or region, this extended model will give insight in the economic consequences of a decision with regard to dry cow therapy. n

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