

TANDEM – A user guide.



TANDEM – The Model.

The model behind TANDEM is intended as a simulation tool to describe some of the effects of fertility management on the performance of the dairy herd. Performance is measured in terms of well established indices of herd fertility such as calving interval and failure to conceive culling, as well as in terms of milk production. One important useful addition is the ability to alter the shape of the lactation curve. The combined costs of fertility are used to give a TANDEM-FERTEX score (£). This index represents a direct cost of fertility to the producer, given certain user-defined individual costs such as the price of replacement heifers and insemination costs. Therefore, the higher the FERTEX score, the more costs need to be met by the producer. The production element of the model calculates the yield of milk and its components (fat and protein), and therefore the value of milk produced for the animals in the herd. The TANDEM FERTEX costs are offset against the milk income in order to give an indication of herd financial performance for any given management strategy.

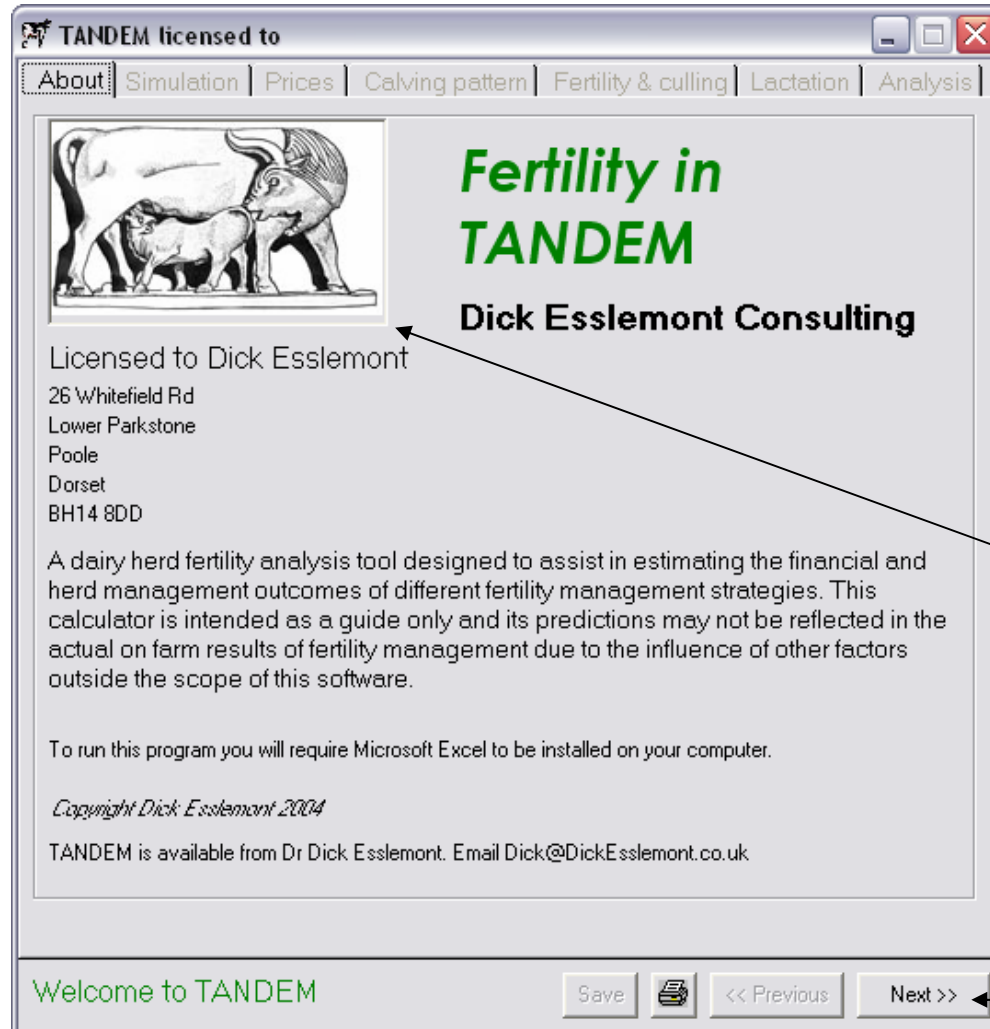
The model runs for a fixed length of time (5 years), having been initially defined with numbers of animals calving in each month, fertility parameters such as voluntary waiting period (VWP), conception rate and heat detection rate, and the various economic costings. The model works by tracking each group of animals (defined as either cows or milking heifers), as they are subject to the various events during a typical lactation. Therefore, the user is able to define certain parameters (heat detection rate, voluntary waiting period, conception rate, lactation curve), according to the month of calving. This helps to create a very powerful tool to examine the effect of shifting calving patterns through changed fertility management practises.

As each animal calves, the model calculates the probability that it will be seen in heat, the chances of it conceiving to a service and it tracks any costs involved. The daily yield is recorded and totalled to give a lactation yield and milk value. Management rules defined by the user are applied to determine when animals leave the herd due to culling for fertility or non-fertility reasons, or when they are due to be dried off. The user can define the serving season and the number of days into lactation when services are stopped.

The results are presented for the last whole final year of the simulation and are intended as a guide to how the effects of fertility management practises can accumulate over the time and manifest themselves on herd performance and ultimately profitability.

TANDEM is therefore, intended as a guide to future performance given the constraints and rules considered within the model. However, there are other factors that are not included within the model that would impact on herd performance. Such factors (e.g. calving costs, calf prices, multiple service periods, and other vet costs et.) may be incorporated as TANDEM develops, and at this stage the user should remember that the results serve only as a guide.

TANDEM – Screen 1.



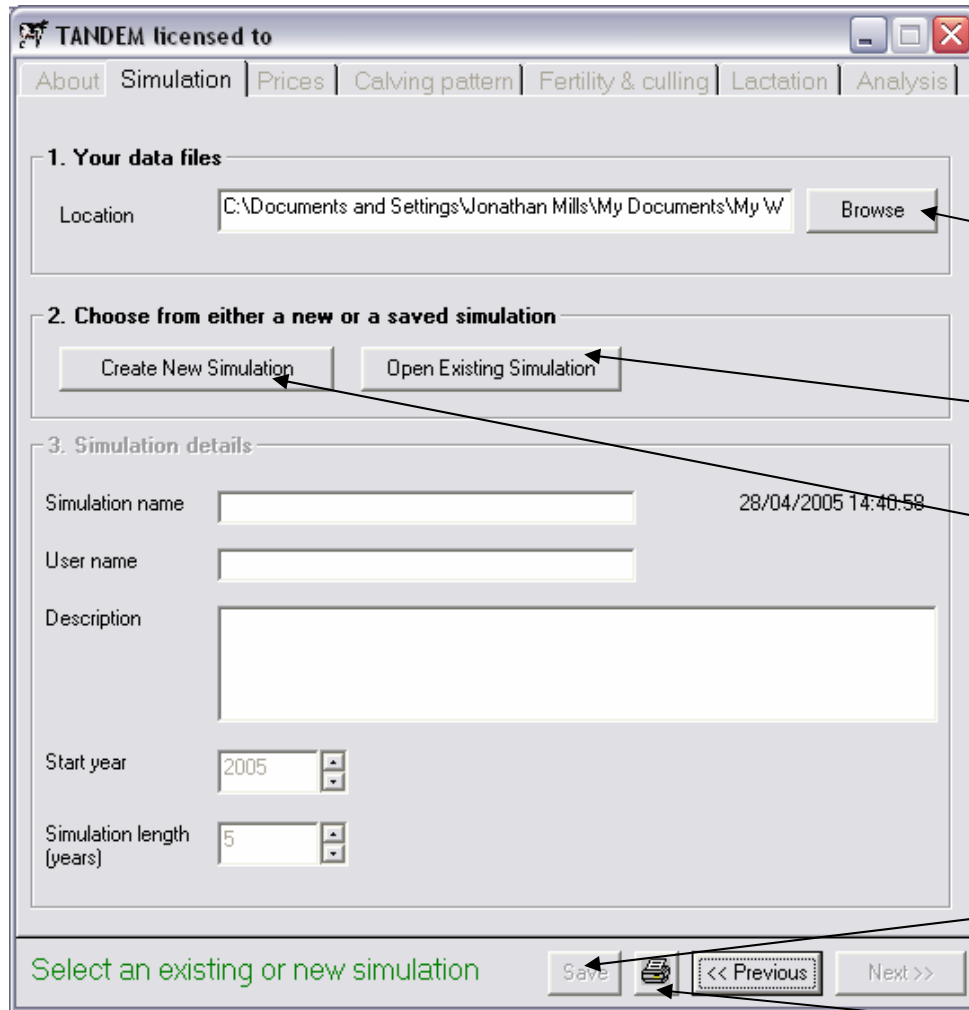
TANDEM comprises seven different input screens, each defining a certain set of characteristics for your dairy herd. These screens are represented by the ‘tabs’ at the top of the screen above, and later you can easily move from screen to screen by pressing the tabs. **Initially** when you start TANDEM, you will be asked to go through all seven screens to check, and edit the data. To do this you use also the ‘Next’ and previous buttons at the base of the screen.

Once you have been through the screens once, you will be able to jump to any particular screen using the tabs on the top and the ‘next’ and ‘previous’ buttons will be replaced by a single ‘calculate’ button

We put your logo here to personalise your copy of TANDEM for your business.

To move click ‘Next’.

Screen 2. ‘Simulation’



You can name a farm or herd, you can make a note of the type of herd you are running, set the start date. You can save and store any run, view the results again in an Excel file and rerun the simulation again following modification.

Click ‘Browse’ to select which folder is used to store your data files

Open an existing simulation from the computer file

Set up a new simulation

Save what I am doing

Print this ‘input screen’

Screen 3. 'Prices'

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About | Simulation | Prices | Calving pattern | Fertility & culling | Lactation | Analysis

Prices

Milk price

Flat rate pricing per litre

Protein & fat payment

Flat rate pricing

Milk price (ppl) 18.000

Protein & fat payment

Protein (pence / % / litre) 3.00

Fat (pence / % / litre) 2.00

Replacement cost

Cost to purchase or rear a replacement (£) 1,000

Cull animal income

Cull cow value (£/animal) 200

Fertility costs

Service cost (£/service) 15.0

Enter prices then click next

Save [Printer Icon] << Previous Next >>

On the pricing screen you can choose either a flat rate (p/litre) for milk produced or put in the price of milk in pence per percentage point of protein (e.g. about 3 pence) and fat (e.g. about 2 pence). To start with it is probably wise to put in a flat rate (e.g. 18.5 pence per litre. You can enter the cost of rearing or buying heifers (e.g. it costs about £1000 to rear a heifer) to replace the culls (whose sale price you set, e.g. £280). You can choose the cost of an insemination and this is intended to allow for the cost of semen and the labour cost associated with undertaking this task (e.g. £25).

Screen 4. ‘Calving Pattern’

Animals calving in year one		
	Cows	Heifers
January	25	15
February	25	5
March	25	0
April	5	0
May	0	0
June	0	0
July	0	0
August	0	0
September	0	0
October	0	0
November	0	0
December	0	0
Total	80	20
Total herd size	100	

Heifer replacements

Calving age (months) 24

Change in herd size (%/year) 0

Service pattern

All year round

Seasonal (Single period)

Service period

Start 1 April

Stop 30 June

Heifers entering herd

Start calving beginning January

Stop calving end of February

Enter details then click next

Save Print << Previous Next >>

Under ‘Calving Pattern’ you can enter the first year’s calving pattern (i.e. what is going on at present and the associated rules determining the service period). There is a column for cows and one for heifers. You can check the total herd size adds up correctly as the individual numbers for each month are set. You can enter ages for first calving (usually 24 – 30 months). Care should be taken to relate any changes in calving age to the cost of rearing replacements to this age. In future versions of the program you will be able to allow the herd size to grow by a set percentage per year if you wish to retain more replacements than cull cows sold, but this option is disabled at present. However, usually the effect of changing fertility management is best observed when choosing to maintain herd size constant from year to year. You can choose between allowing the herd to calve all year round or to set a seasonal calving pattern based on a service window between two dates. Heifers need to enter the herd calving over a set period of months, though for all year round calving herds this can be January to December. For seasonally calved herds the dates need thinking out accurately to keep the pattern stable.

Screen 5. 'Fertility & Culling'

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Fertility parameters

Herd parameters (Independent of calving month)

	Cows	Heifers
Oestrous cycle length (days)	21	21
Gestation length (days)	281	281
Max service window (days after calving)	186	186

Fertility parameters for all cows and heifers

All calving months

	Cows	Heifers
Voluntary waiting period (days)	45	45
Submission rate (%)	90	90
Conception rate (1st serve) (%)	55	55
Conception rate (2nd +) (%)	55	55

<< Previous month Next month >>

Use same parameters for all calving months

Culling policy

Average no. of lactations at start	3.0
Maximum no. lactations	10
Other non-fertility culling (% cows/year)	10

Enter fertility parameters then click next Save << Previous Next >>

You can choose the length of the oestrous cycle (though 20 or 21 days should be used as that is what it is!), the gestation length (approx 282 days, but there are differences between breeds and even sires), and the maximum service window (200 to 250 days is usual depending on your desire to reduce culling and keep yields up). Seasonal calved herds usually only have 186 days or so to get the cows in calf after calving as a maximum. This maximum service window is the maximum number of days after calving before which any animal failing to conceive will be culled. This is an important component of fertility management and it should be thought about carefully. In the UK all-the-year-calving herds usually leave 160 days (about 8 oestrus cycles) to get the cows pregnant so if the Voluntary Waiting Period is 50 days, the Maximum Service Window will be 210 days. In seasonally calved herds, where animals calve near the end of the service season (as defined in seasonal herds above), they will get less opportunity to conceive as the maximum service window will be overridden in the program by the final service date. Culling for Failure To Conceive is very sensitive to this setting and this is where the money is made or lost.. Top herds with good fertility can keep their Maximum Service Window down to 180 days and still have a low Failure To Conceive culling rate. The user can put in the Voluntary Waiting Period (VWP), Submission Rate (or Heat Detection Rate), and the Conception Rates to first and other services. The Voluntary Waiting Period is the gap or rest that the cow is

given after calving before being considered for service. 50 days is the target for many dairy herds, but by altering the VWP the cost of delay can be calculated in TANDEM. It is important to remember that conception rate at first service may decline with decreasing VWP and this should be set accordingly.

Giving the least fertile cows about 180 days to get in calf, ie till 230 days after calving (50 plus 180 days), offers them a maximum of about nine oestrus cycles. In typical UK herds even this leads to high rates of culling for FTC (about 17 to 22%) so there is lots of scope for improvement in Heat Detection, Conception Rate and VWP. Many farms that would benefit from higher milk prices by having seasonal calving, have had to give up trying to hold the pattern to keep the FTC culling down. A Voluntary Waiting Period of 50 days, Heat Detection of 80% plus and Conception Rates of 50% do wonders for annual milk yields and do not raise FTC culling.

Submission rate is the rate of heat detection and submission for cows for service (usually AI). The UK average is about 50% and the target for a top performing herd should be 80%+. To maintain an efficient, seasonally calved herd, calving over, say, 10 weeks or so you need to aim for 90% heat detection rates and 50% conception rates or you risk paying the price in FTC culling costs. (This is how the New Zealand dairy farmers make their living and they keep their FTC culling to 6% or so).

Conception rate is the rate at which cows served conceive to any one service. The UK average is 40 to 45% and the target should be 55% or more. Usually first and subsequent services display similar rates although this relationship may change if the herd has very short intervals of VWP.

The mean herd age in lactations is also set to determine the likelihood of animals leaving due to old age (only where fertility is good) as set by the maximum age parameter. A rate representing the loss of animals from the herd for non-fertility reasons is also set. These animals are those lost to disease such as mastitis and lameness. To see the effect of fertility on the culling this factor should be set to zero. Otherwise, this rate should be set to around 10-12% (UK average), unless these factors are a major problem in your herd. Target FTC culling should for most herds equate to around 6%, thereby giving a target total culling rate of around 16-18%.

Setting the maximum allowable age parameter too low (less than 6 or 7) will probably risk excessive culling for age unless fertility is exceptional. If the fertility management is very good it may pay a farm to sell cows for age (say, 8 lactations and over) as the old cows have lower yields, more mastitis and lameness and may not have profitable lactations in high yielding herds. It is worth looking at the affect of age on profitability, lactation by lactation. Often running TANDEM with zero set for the proportion sold for old age etc, will highlight the effect of fertility mis-management more clearly.

Screen 6. 'Lactation Parameters'

Lactation parameters for all cows and heifers

All calving months

Parameter	Cows	Heifers
Litres per 305 days	7,057	5,602
Dry period (d)	56	56
Yield threshold for dry off	10.0	10.0

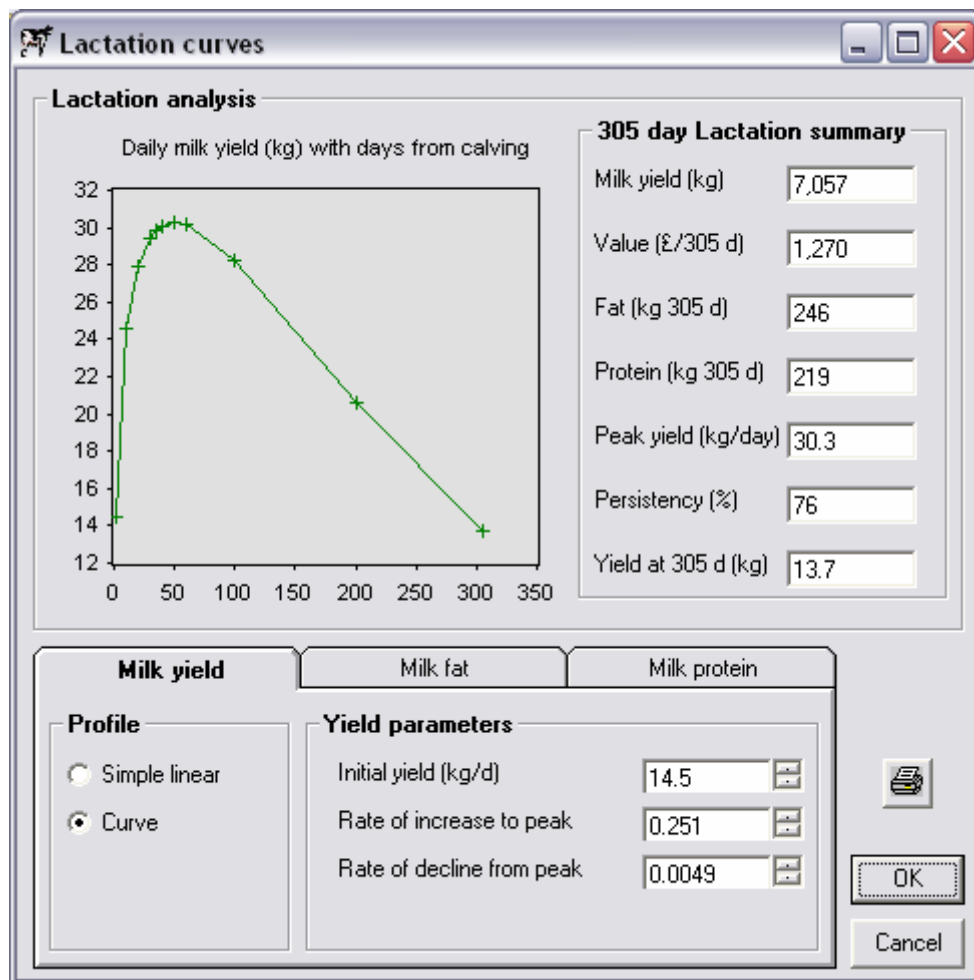
Use same parameters for all months

<< Previous month Next month >>

Edit lactation details then click next Save << Previous Next >>

By juggling with the driving wheels you can enter lactation curves (for heifer and cow lactations) that reflects the milk yield and quality shapes for your herd. You can alter the minimum dry period in days and set the yield level per day at which drying off will take place anyway, (often around 10 litres/day).

The shape of the lactation (and hence yield), is altered by selecting 'Edit Lactation Curve' from the main screen. An additional screen should be displayed that allows you to alter the shape using the variables for milk yield, fat or protein. The curve shape will determine the cost of the lost milk per cow per year with changing calving intervals, so it is important to give it careful consideration. You cannot edit the yield directly without using the parameters that define the shape of the curve. The parameters to manipulate are Yield at Calving, Rate of Increase to Peak, and Rate of Decline from Peak. Ask the farmer to tell you (or dig it out from the farm records) the peak yield and the yield at 305 days for cows and heifers so you can set the curve shape to reflect the actual shape. Heifer lactations are about 75 to 80% of mature cow yields.



Two different styles of lactation curve are allowed. Firstly there is the ‘Simple linear’ or ‘broken stick’ model. This allows the user to input a typical initial yield, peak yield, days to peak and 305 day yield.

A more representative (but more complex) curve shape is also offered where the rate of increase and decline from peak are the important factors to set along with the initial yield.

Initial Yield, Rate of Increase to Peak and Rate of Decline from Peak are what you change to alter the curve shape

We suggest that you familiarise yourself with the effect that these parameters can have by using the up and down buttons to make small changes from the default values for Initial Yield (kg/d), Rate of Increase to Peak and Rate of Decline from Peak.. Watch what happens to the shape of the curve but also to the 305 day yield.

The minimum dry period and the yield threshold for drying off will combine to determine the actual day that each animal ends its lactation. This day will be the first to occur of either the animal reaching the minimum allowable yield on the lactation curve, or the deadline before the next calving.

Today flatter lactation curves are more common and **high yielding Holsteins, well fed via TMR and using little grazed grass** may have lactations that peak at 50 litres and still give 30 litres at 305

days. Heifers in such herds may peak at 35 litres and give 23 litres at 305 days. Cows that fed less well or that are grazed in the summer often have more spikey lactations, peaking at, say, 35 litres and drying off at 12 litres at 305 days. Users can alter fat and protein curves and it is suggested that users leave this to TANDEM to calculate from standards until they have mastered the rest of TANDEM.

With this copy of TANDEM comes a set of example input screens and out puts for a 100 cow fertile high yielding herd. You will notice that there are printouts covering the cows in the herd, the heifers in the milking herd and the total herd. Usually it is the whole Herd printout that is most useful. There are also a set of charts which can be produced best on a colour printer. These may be most usefully observed on-screen while working with the client .

Screen 7. 'Analysis'

Sensitivity analyses

Display sensitivity tables with data expressed as + or - difference from main run
 Display sensitivity tables with actual values
 Adjust parameters equally for heifers and cows

Herd

Parameter 1
 Heat detection rate, % Increment: 10

Parameter 2
 Voluntary waiting period, (days) Increment: 10

Choose options and click Calculate Save CALCULATE

TANDEM gives you the capability to perform a sensitivity analysis on the following aspects of management when compared against your standard run:

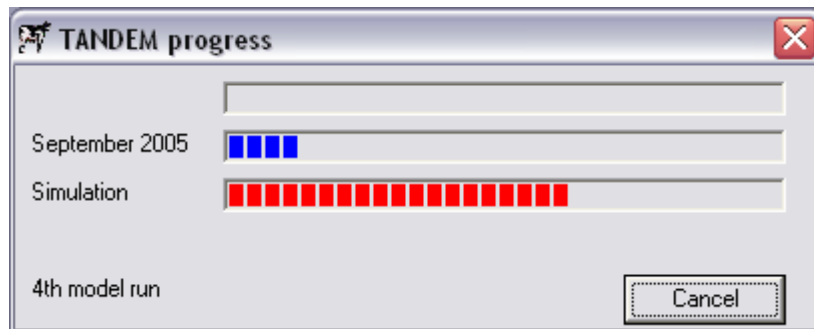
1. Conception Rate to First Service
2. Conception Rate to Second and Additional Services
3. Submission Rate (Heat Detection Rate)
4. Voluntary Waiting Period

The idea is for TANDEM to compare on the printout how small changes (10% would be sensible) above and below your standard affect the herd performance over time.

It is sensible to set the choice of your sensitivity parameters to be the same for cows and heifers by keeping 'Adjust parameters equally for cows and heifers' ticked. However, for more detailed analyses, you can alter this option.

Once you are happy with the set up for your herd, Press 'Calculate'. The model will take a while to run depending on the speed of your computer and the progress of the calculations can be watched on the screen (see screen image below). TANDEM simulates five years for each run to show you what happens when things have settled down. Each 'run' represents one particular combination of parameters for the sensitivity analysis.

TANDEM uses Microsoft Excel to display the results in separate worksheets for the 'Herd', 'Cows', 'Heifers', and



finally the ‘Charts’. The charts display the results for your chosen “base” run and not for the sensitivity analyses. Generally, in practice on a farm the components you can manage most easily are Voluntary Waiting Period and Heat Detection Rate.

Save the run as you would an Excel spreadsheet so you can use it as your starting point again. It might be helpful to set up 4 or 5 standard herds with 100 cows in to demonstrate the outcomes of typical levels of achievements in terms of fertility management. (i.e. for an All Year Round Calving Herd, with Flat

and Normal Lactations, each with Excellent, Good, Average and Poor levels of Heat Detection, Pregnancy Rate, Voluntary Waiting Period, which means 6 standards. This could be set up for Spring and Autumn Calving Herds so that means 18 standard herds.).

A set of printouts show the inputs and outputs for a typical UK herd of 100 cows with average (which in the UK is poor!) fertility parameters.

The program arrives with some typical examples of 100 cow herds – All Year Round Calving, Spring Calving and Autumn Calving to get you started. These are Excel spreadsheet files that can be loaded into the program at the start. They should be found in your TANDEM Folder on your PC.

The system that works best is, once you have practised with the example herds is to set up your own demonstration herds from scratch and to use them to demonstrate the scope of improved fertility management to customers. When the user is confident, separate farm examples can be put in and stored to help to advise particular clients. It is worth saving these programs with a clear name and date in the name.