Mastatest

Powering Mastitis Decisions

mastatest.com

THE MASTITIS PROBLEM

Mastitis is one of the most common and costly health conditions in a dairy herd. It is an inflammation of the udder that can be caused by bacteria, other pathogens, or injury. Estimates of the cost impact vary, but are commonly estimated to be in the range of $400 USD (£250 GBP, €250) per clinical case. With average herd incidence in the range of 20-30% per annum for many farms, the cost can be significant.

Historically every case of mastitis would be treated with an antibiotic, without any knowledge of what the cause was likely to be. However, studies show that up to 50% of mastitis cases are unlikely to benefit from antibiotic treatment, either because they are not bacterial in cause, or they are caused by gram-negative bacteria. This blanket treatment approach therefore results in both the over-use of antibiotics, and unnecessary milk losses due to the extended milk withholding periods required after antibiotic treatment.

In addition, a farm would historically have no data with which to guide the usage of antibiotics. Instead all infections would be treated in the same way, regardless of whether that approach was likely to be most effective. In some instances, difficult mastitis cases might have required two or three courses of different antibiotics until one could be found to resolve the infection.

Modern dairy farms must be constantly seeking ways to increase efficiency, reduce costs, and increase productivity. Mastatest is a solution that enables the modern dairy to achieve this in the context of mastitis management. By testing each mastitis case for the type of bacteria, and its antibiotic sensitivity, each animal can be given the optimal management approach, first time.

WHAT IS MASTATEST:

Mastatest is a quick, and easy-to-use diagnostic test for mastitis in dairy cows. Within 24 hours, it can determine the presence of bacteria in the sample, which species the bacteria is, and its sensitivity to common antibiotics.

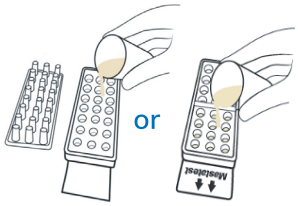
The system is based on the principle of “colourimetric analysis” whereby the colour-changes in the milk sample caused by the presence of specific types of bacteria can be precisely read to give diagnostic information.

The entire process can be carried out on the farm, with limited training for staff. Results are returned to the farm team fully analysed and interpreted, so all that is required is for the farm team to action the results.

They were amazed at how easy it was to use and how much valuable information we received from a sample.

HOW IT WORKS:

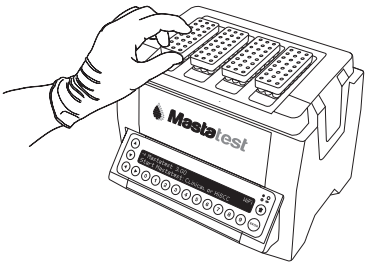
There are four components to the Mastatest system:



1. The cartridge

The Mastatest cartridge contains 24 wells that are filled simply by pouring a milk sample over the cartridge and tipping off the excess. This process takes seconds, and no scientific skills or technical training are required making it ideal for on-farm use.

Each cartridge is pre-filled with the reagents required to carry out a specific test on that sample. The 24-well design means that each sample is simultaneously tested for multiple bacterial types. In some cartridge types, sensitivity to common antibiotics (as measured by minimum inhibitory concentration, MIC) is also tested.



2. The Lapbox

Once filled, a Mastatest cartridge is placed in the internet-connected Lapbox device. The Lapbox is an incubator, and an electronic sample reader all-in-one.

Once a test is initiated on the Lapbox, the in-built high definition camera begins taking images of the reactions in each of the wells at pre-determined timepoints. These images are transmitted to our cloud-based server for analysis and interpretation of the colour-change reactions.

3. Analytical algorithms

Images taken within the Lapbox are transmitted to the cloud for analysis and interpretation using our proprietary algorithms. Samples are read using our Machine Learning Algorithm, and also analysed personally by our expert microbiology team where there is any uncertainty.

Results, which show bacterial presence, bacterial species, sensitivity to antibiotics (where required), and the vet-determined protocol (where set) are then automatically sent to the client via email and uploaded into their personal portal account.

4. Client and Vet portal

The final element in the system is our data portal. Each client, and their veterinary team, has a unique log-in to the portal where they can access the data from each test, and for their herd on a longitudinal basis.

Using the portal, a farm's vet can set a standard treatment plan. This means that in addition to the farm receiving data on the sample test results, they will receive a specific treatment recommendation.

The portal also comes equipped with data analysis and reporting options, so farmer and vet can analyse their results, and use the data to enhance their mastitis management, and optimize herd decisions.

WHAT MASTATEST TESTS FOR

Mastatest has various cartridge options available in each geography, depending on the specific needs of farms in that location. Specific details of the inclusions in each cartridge type can be found in the appendix.

Clinical mastitis testing:

Most clinical cartridge options test 1 sample per cartridge, and detect the following bacterial types:

- *E.coli* and other gram negative bacteria
- *Klebsiella* and *Serratia*
- *Streptococcus uberis*
- *Streptococcus dysgalactiae*
- Other *Streptococcus* species
- *Staphylococcus aureus*
- *Coagulase Negative Staphylococcus* (CNS, aka *non-aureus Staphylococcus* (NAS))
- Other gram positive bacteria

In addition, sensitivity to 3-6 antibiotics is tested. The choice of antibiotics varies for each market, but commonly include products such as benzylpenicillin, cloxacillin and first generation cephalosporin e.g. cephalexin.

In some markets, an alternative clinical mastitis cartridge "MAST1" is available which focusses on identifying the bacterial type only. Two samples can be run in each of these cartridges.

Subclinical mastitis testing:

For subclinical mastitis, where herd testing or in-line sampling has identified a raised somatic cell count (SCC), a specific "HiSCC" cartridge is available. Two samples can be run in each cartridge.

This cartridge utilises an alternative analytical algorithm that focusses on the identification of key contagious pathogens that may be present. The cartridge identifies:

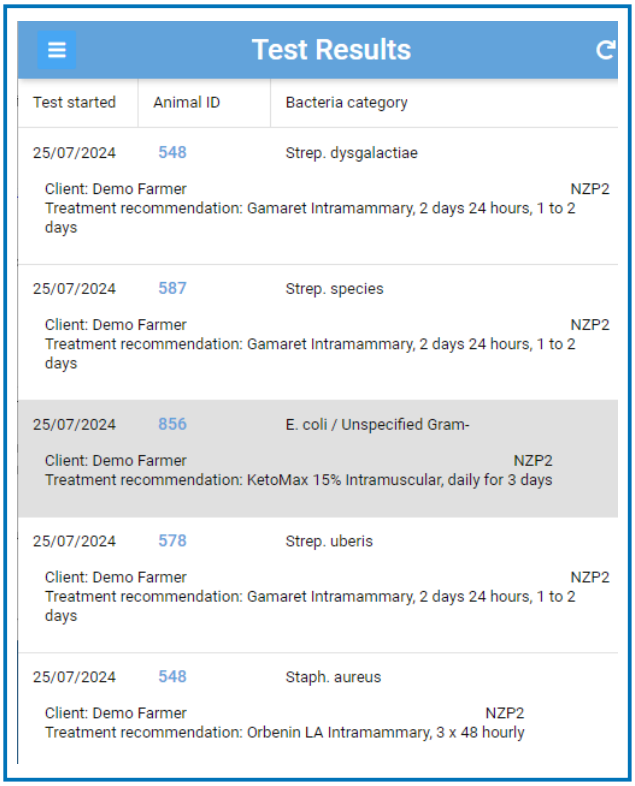
- *Staphylococcus aureus*
- *Coagulase negative staphylococcus* (CNS, *non-aureus Staph*, NAS)
- Other gram positive bacteria
- Gram-negative bacteria

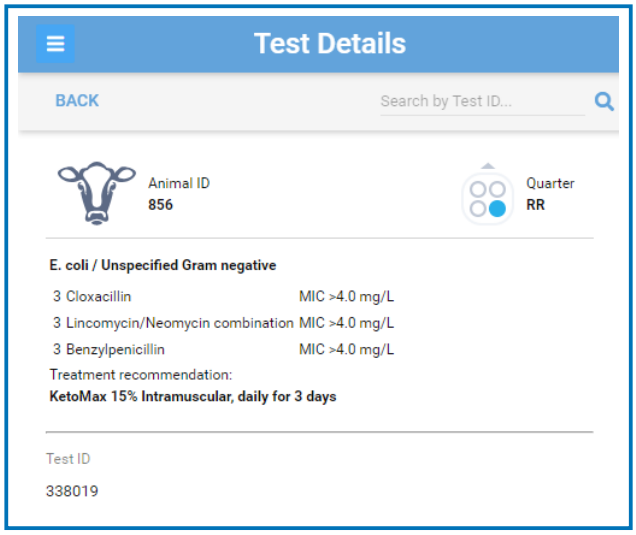
Identification of subclinical *Staph. aureus* infections in particular can help a farm contain the spread of this difficult-to-manage pathogen.

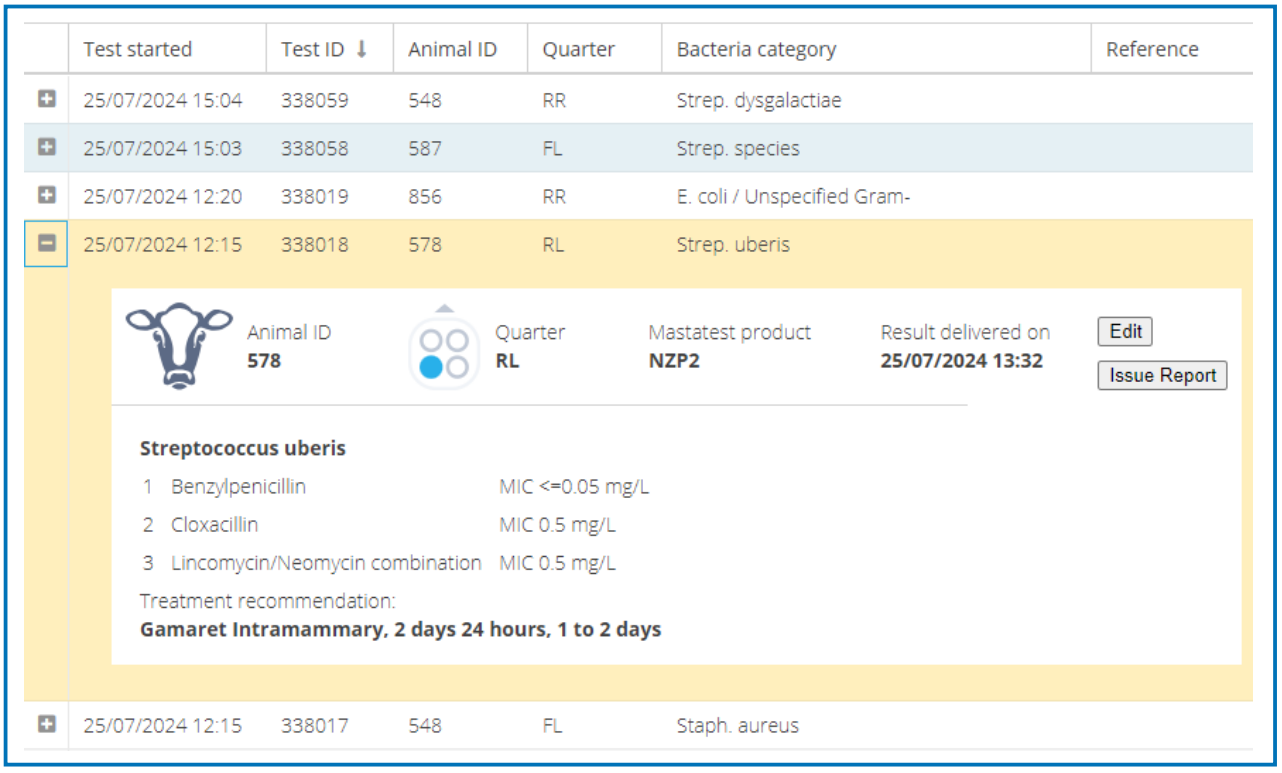
This cartridge can also be used at dry-off, where the results can be combined with other data collected from Mastatest (such as the incidence of clinical mastitis through the season) and other sources (e.g. somatic cell count data from herd testing, milk volume data) to inform individual management and cull decisions.

MASTATEST RESULTS:

Mastatest results from a test are emailed to the client, and uploaded into their portal account within 24hrs (viewable on mobile or desktop). Here's what you'll see:







THE MASTATEST ADVANTAGE

Dairy farms are busy places. Mastatest is quick and easy to use, and can deliver productivity and efficiency benefits from day 1.

1. Easy to use and integrate on farm

The Mastatest system is quick and easy to use, and requires minimal training.

A cartridge can be filled, and a test started on the Lapbox in seconds. Once the test is started, no further action is needed – the sample will be processed, and the results returned on email (and within the portal), analysed, interpreted and ready to be actioned.

2. Better informed mastitis decisions

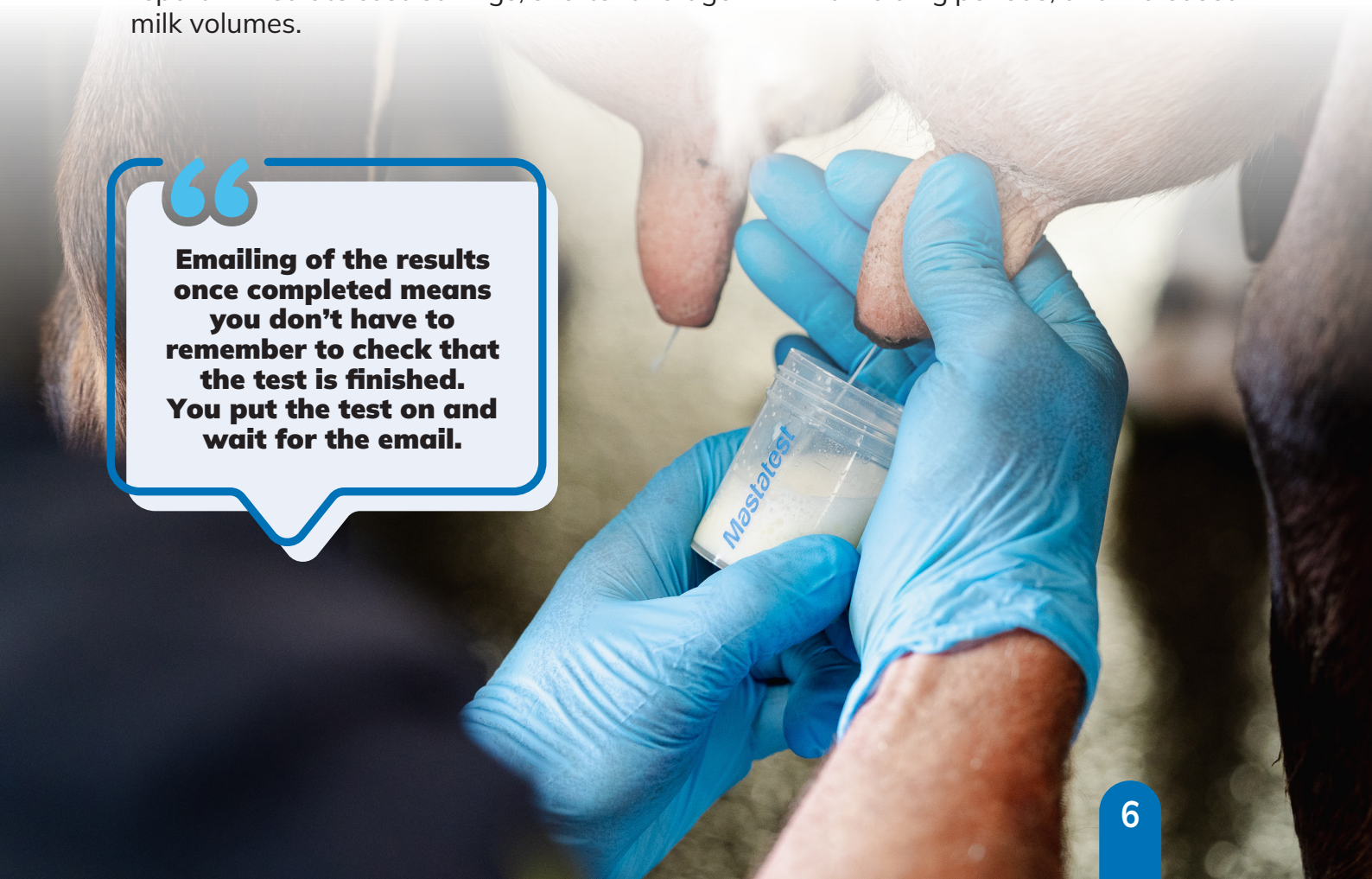
With Mastatest, you'll know whether there are bacteria present, what species, and what its antibiotic sensitivity is. If your vet has set a protocol, then you'll also receive the recommended treatment plan, specific for each mastitis case. This means the optimal treatment plan each and every time.

In addition, all of your mastitis data for the herd is automatically collated within our online portal. This valuable data set will mean you can more effectively plan mastitis control activities, and make better informed cow and herd health decisions.

3. Increased productivity

Mastatest is has been proven to reduce antibiotic usage, by helping farmers and vets identify which cases are, or are not, likely to respond to antibiotics. The integrated application of antibiotic sensitivity testing also enables selection of the right antibiotic each time, giving you the best chance of a first-time cure.

By reducing the usage of antibiotics, and increasing first-time cure rates, our clients report immediate cost-savings, shorter average milk withholding periods, and increased milk volumes.



Emailing of the results once completed means you don't have to remember to check that the test is finished. You put the test on and wait for the email.

TECHNICAL VALIDATION

Jones and colleagues[1] conducted a comprehensive evaluation of the sensitivity and specificity of bacterial culture testing of mastitis samples conducted using Mastatest, as compared with standard bacterial culture testing completed in a laboratory.

A total of 292 milk samples, taken from identified clinical mastitis cases across 7 New Zealand dairy herds, were included in the study. Each sample was collected aseptically, and tested within 1 hour of collection using Mastatest. Remaining milk was frozen for transport to a reference laboratory, where it was defrosted and tested using laboratory procedures recommended by the National Mastitis Council.

The results (Table 1) showed Mastatest was not inferior to testing in an accredited laboratory with regard to sensitivity (identification of true positives) or specificity (identification of true negatives). In fact, there was some indication it had higher sensitivity than the standard methodology for identification of "all bacterial", and "coliform" bacteria.

	Sensitivity		Specificity	
	Mastatest	Lab Culture	Mastatest	Lab Culture
All Bacteria	95%	91%	72%	74%
S. uberis	88%	89%	80%	78%
S. aureus	88%	84%	96%	98%
CNS	90%	81%	94%	94%
Coliforms	77%	54%	99%	99%

***Table 1**: Sensitivity and Specificity of Mastatest vs Lab Culture*

Antibiotic sensitivity testing was carried out using Mastatest and the laboratory reference methods, across the dilution range ≤0.05, 0.1, 0.5, 1,2,4,>4mg/L). Overall, the two methods were shown to show similar distribution trends, and were in good agreement. There was a maximum one-dilution difference in mean MIC value across the antibiotics tested. Table 2 shows an example of MIC50 values for different antibiotics against Step. uberis isolates. A critical difference was that Mastatest was able to generate the data within 24 hours, compared with the required 3-5 days in a reference laboratory.

	Mastatest	Lab Reference Method
Benzylpenicillin MIC50	≤0.05mg/L	0.1mg/L
Cloxacillin MIC50	0.5mg/L	1mg/L
Lincomycin/Neomycin MIC50	0.5mg/L	0.5mg/L

***Table 2:** Comparison of MIC50 data for Strep. Uberis from Mastatest vs Reference methods*

Overall, this study supported the validity of the use of Mastatest as an on-farm point-of-care diagnostic to enable farmers and their veterinarians to make informed decisions about clinical mastitis management in a timely way.

ON-FARM VALIDATION

A comprehensive evaluation of the selective treatment of mastitis by farms using Mastatest was undertaken by Bates and colleagues[2]. The objective of the study was to evaluate whether selective treatment based on Mastatest results could control antibiotic usage without compromising clinical outcomes.

Mild to moderate mastitis cases in the 100 days after calving in 6467 cows from 7 farms were milk sampled, and randomly allocated to non-selective treatment, or selective (culture-guided) treatment group. All milk samples were processed using Mastatest.

In the non-selective treatment group, the affected quarter was treated immediately with 3 treatments of procaine penicillin every 12 h.

For the selective treatment group, treatment was delayed for 24 h and then informed by pathogen and antibiotic sensitivity from the Mastatest result. Gram-negative and no growth quarters were untreated. Gram-positive quarters were treated with the antibiotic for which the lowest in-vitro antimicrobial sensitivity was reported.

Re-sampling was carried out from affected quarter(s) approximately 21 days after initial diagnosis and cultured for bacterial identification. Clinical recurrence within 60 days and ISCC data was recorded at herd tests over the duration of the lactation. Antimicrobial usage and days of milk wit hold pending clearance of antibiotic residues were also noted.

Complete data records were available for 535 samples - 276 samples in the selective treatment group, and 259 samples in the non-selective treatment group.

The study results showed that there were no differences in the clinical outcomes between the selective or non-selective treatment groups, as measured by bacteriological or clinical cure rates, or individual somatic cell counts (ISCC) taken before dry-off.

Overall the study showed 8.6% of samples where there was no bacterial growth, and just 3.2% of samples where coliforms were identified. However, mean antibiotic usage was 24% lower in the selective (Mastatest-guided) treatment group. This indicates that even in this cohort with very rates of coliform infection, that selective treatment can have a significant impact on antibiotic usage.

References:

1. Jones G, Bork O, Ferguson SA, Bates A. Comparison of an on-farm point-of-care diagnostic with conventional culture in analysing bovine mastitis samples. J Dairy Res. 2019 May;86(2):222-225.

2. Bates A, Laven R, Bork O, Hay M, McDowell J, Saldias B. Selective and deferred treatment of clinical mastitis in seven New Zealand dairy herds. Prev Vet Med. 2020 Mar;176:104915.

The Mastatest system paid for itself five times over in the first season, from reduced milk itholding and by not buying as many drugs”

VETERINARIAN TESTIMONIALS:

Dr Andrew Bates

Dairy Science Director, Centre for Dairy Excellence; and Senior Veterinarian, VetLife

What is the importance, to you, of antibiotic sensitivity testing?

As a production animal vet, antibiotic sensitivity testing is primarily of value to me when used to indicate trends in antibiotic microbial resistance and to confirm the most appropriate class of antibiotic to use. The Mastatest system allows the collection of this data from multiple clinics, regionally and nationally. This increases my ability to prescribe antimicrobials prudently and appropriately.

What would you tell another vet considering using the Mastatest system?

It's a rapid and simple system. Within 24 hours it can confirm whether the mastitis is due to a *Staph aureus, Strep uberis, CNS staph, coliform* or other strep species. The result includes the antibiotic with the lowest MIC value. Ease of use and speed of turn-around time within the clinic means that sampling becomes a more attractive option for clients and easier for veterinary staff. Client engagement, veterinary understanding of the etiology and epidemiology of mastitis on farms and prudent stewardship of antimicrobials are all demonstrably increased.

Josh Wheeler

QCONZ Consultant

What feature sold you on the Mastatest system?

Easy to use. No interpretation required. Once the test is loaded you don't need to remember to check result at a certain time, as the result is just emailed to you. Data is kept of all results for each farmer, meaning better information is available for the farmer to review their previous seasons performance with the veterinarian.

Ian Hodge

Veterinarian; and PureMilk Consultant

What is the importance, to you, of antibiotic sensitivity testing?

The rational and responsible use of antibiotics in food animal practice requires more knowledge of the sensitivity of bacteria to the antibiotics we have. Achieving better clinical outcomes when treating animals improves animal welfare.

What would you tell another vet considering using the Mastatest system?

The Mastatest system is easy to use with a quick result turnaround. The reporting system always goes through the veterinarian. The system is designed also to be used on farm where it will probably be most useful in enhancing the success of mastitis management.

FARMER TESTIMONIALS

Gordon McFetridge

Farmer, (Tauranga, New Zealand)

How has the Mastatest system made your job easier/ more efficient?

Better understanding of what bacteria are causing our mastitis infections and the antibiotics that will work best on the infections. Previously we have tried the sending samples in for culturing, and culturing myself. But Mastatest is a faster, simpler and cheaper solution and provides more information.

What feature sold you on the Mastatest system?

Emailing of the results once completed means you don't have to remember to check that the test is finished. You put the test on and wait for the email.

What would you tell another farmer considering using the Mastatest system?

Very easy to use. By targeting the right treatment for each mastitis case you will get better cure rates, and this has been the most benefit on our farm. We have had less cows we have treated two or three times.

Carissa Koeppel

Herd Manager, Kinnard Farms (Wisconsin, USA)

What has been the feedback from the farm team?

The feedback from the team using Mastatest has been very positive. They, as well as myself, enjoy the fact that it is very straightforward and easy to understand. It is also quick to start a new test. As we all know, on a dairy farm there is always something to do, time is of the essence. The fact that this is very time efficient has been a huge plus for us.

What benefits have you seen with the use of Mastatest?

The ease of using these tests is a huge benefit in my opinion. If you make things easy, people will do them! Before using Mastatest, I needed to wait 48 hours before having an answer and sometimes results were difficult to determine. Now, results come in around 21 hours and they are clear. It states exactly what grew and recommended treatment options. We have less waste milk due to the fact we are getting results sooner, and able to make treatment decisions in a timelier fashion. Mastitis cases are resolved, and cows are able to move out of our hospital pen quicker.

What advice would you give for farms considering introducing mastitis culture testing?

I would advise you to at least try out Mastatest, see if it is the right option for your dairy. Not one thing works for everybody, but you would be surprised at the benefits this new technology provides. The results are fast and very accurate. We all know how important it is to culture mastitis samples, so why not make that an effortless task?

If you are unsure if this could work on your dairy, reach out to Mastatest, the support I receive from them is fantastic and I know they'd be more than willing to answer any questions and walk you through how to best utilize this on your farm.

Corey Hordoff

Owner/Manager - Second Look Holsteins (Wisconsin USA)

What has been the feedback of the team members using Mastatest?

They were amazed at how easy it was to use and how much valuable information we received from a sample.

What benefits have you seen with the use of Mastatest?

We now have treatment protocols set up to treat each mastitis case by the bacteria and antibiotic sensitivity which has meant less time that a cow has been in the hospital pen and we are treating only the animals that need to be treated and they are treated with the appropriate antibiotic.

What advice would you give for other farms who are considering introducing mastitis culture testing, and specifically Mastatest.

Mastatest has changed the way that we treat our mastitis cases making us more efficient, reducing our antibiotic usage, and increasing production by reducing time spent in the hospital pen.

Mastatest is easy to use and we now know what bacteria is the most prevalent in our herd so we can take steps to make our herd more healthy and profitable.

Arjan

Farm owner and Sharemilker (North Otago, New Zealand)

What benefits have you seen with Mastatest?

In the two years of running Mastatrest, we have seen a drop in the usage of antibiotics. The results we get from Mastatest provide us with targertted information on bacteria and antibiotics. And by using the right antibiotics we get really good cure rates. Cows are cured right away with the first treatment. It has helped our focus of being sustainable for the environment, for animal health, and for the dairy industry.

Andrew

Farm owner (Waikato New Zealand)

What benefits have you seen from using Mastatest?

The Mastatest system paid for itself five times over in the first season, from reduced milk itholding and by not buying as many drugs”

Toby

Herd Manager (Dorset, UK)

What benefits have you seen from Mastatest?

“On-farm bacteriology [with Mastatest} has meant we have halved the number of mastitis cases treated with antibiotics”

Luis

Assistant Manager (Colorado, USA)

How have you found integrating Mastatest onto your farm?

The Mastatest Lapbox is easy to use and starting a Mastatest is straight forward. I like this system because I don’t have to do any culture plate interpretation. I can recommend Mastatest to other dairy farmers as I have worked with it, and speak with experience of using this system

Cartridge Specifications:

Cartridges come individually foil-wrapped, in cartons of ten units. They can be puchased from your distributor, and in some markets ordered direct from Mastaplex within the customer portal.

They should be stored at 2-8C, and used before the expiry date printed on the carton and cartridge wrapper.

Product Code	Market	Usage	Type	Carton Size	Antibiotics
NZP2	NZ	Clinical	Single	10	Benzylpenicillin, Lincomycin/Neomycin , Cloxacillin.
NZP4 EUP4 AUP4	NZ EU AU	Clinical	Single	10	Benzylpenicillin , Cloxacillin, Tylosin.
UKP1 EUP6	UK EU	Clinical	Single	10	Benzylpenicillin, Cloxacillin, Cephalexin.
USP2	US	Clinical	Single	10	Cephapirin, Ceftiofur, Cloxacillin.
MAST1	US	Clinical	Twin	10	n/a
EUP5	EU	Clinical	Single	10	Benzylpenicillin, Cloxacillin, Tylosin, Ampicillin, Cefapirin, Oxytetracyclin.
EUP7	EU	Clinical	Single	10	Bezylpenicillin, Cefapirin, Amoxicillin / Clavulanic, Acid.
HiSCC	GLOBAL	Subclinical Dry-off	Twin	10	n/a
AUP1	AU	Clinical	Single	10	Benzylpenicillin, Tylosin, Trimethoprim/ Sulphadiazine.
AUP3	AU	Clinical	Single	10	Benzylpenicillin , Cefuroxime, Cloxacillin.
AFP3	Africa	Clinical	Single	10	Cefalexin, Cefuroxime, Cloxacillin/Ampicillin.
AFP4	Africa	Clinical	Single	10	Benzylpenicillin, Tylosin, Marbofloxacin.
AFP5	Africa	Clinical	Single	10	Ampicillin, Oxytetracycline, Cephalexin.

Generation 2 and 3 Lapbox specifications

Set-up location	The ideal set-up location is in a clean, dry space, close to the milking shed .
Operating conditions	For best functioning, operate the Lapbox at a room temperature between 5-30C.
Capacity	Each Lapbox can process 4 test cartridges at any one time. Cartridges can be started independently of each other at any time. Based on an average clinical mastitis rate, one Lapbox should have sufficient capacity for a herd of up to 1000 cows. Your distributor can provide advice on what may be required for your farm.
Internet requirement	Ethernet (cable provided) OR WiFi connectivity. Follow the set-up protocol for your Lapbox model, described in the in-box instructions.
Power	One standard power connection required (cable provided)
Data accessibility	Your portal account is accessible on mobile or desktop at mastatest.com or mastatestsystem.com
Support	support@mastatest.com
Cleaning	Wipe down of the internal and external surfaces is necessary on a regular basis. Use a clean damp cloth (water only) and then dry surfaces with a second dry cloth. Instructional videos are available at mastatest.com

Mastatest

Further information and sales enquiries

Website: mastatest.com

Videos: mastatest.com/user-guides or vimeo.com/Mastatest

Enquiries: mastatest.com/get-in-touch or info@mastatest.com

Request a quote: mastatest.com/lapbox-order-form

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