丹麥與臺灣乳牛場使用機器人科技研討會
SMART DAIRY FARMING WITH ROBOTS: DEMARK & TAIWAN

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乳牛群性能改良所需機器人願景
Vision on Performance of Dairy Herd Improvement Associated Robots

大綱
OUTLINE

- 臺灣乳牛群性能改良計畫 (DHI) 背景與現況

DHI program in Taiwan

- 擠乳設備趨勢與議題

Current trends and issues of milking system

- 泌乳紀錄來源之替代可能

Alternative strategy for labelling lactation records

- 結論

Conclusion

臺灣 DHI 計畫背景與現況
DHI PROGRAM IN TAIWAN

- 1977年開始辦理 DHI ，是乳業推動最重要計畫之一

DHI is one of the most important projects for dairy farmers since 1977 in Taiwan

- 每月收集乳牛群產乳量及乳品質資料等

Collecting data from dairy herds such as milk yield and milk components every month

資料收集

Milk samples collecting

乳樣分析

Milk samples analyzing

資料處理

Data processing

ICAR THE GLOBAL STANDARD FOR LIVESTOCK DATA

報告組成

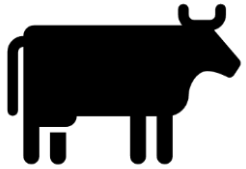
Report generating

畜群管理

Herd management and decision making

繁殖紀錄

Herd reproduction data



產乳表現

Milk traits performance data

健康紀錄

Herd health disorders data

DHI

Helping farmers manage and make the decision of their herd

Improving herds milk traits and health performance

Participating in international organization (ICAR)

DHI 酪農及牛數
DHI HERDS AND COW NUMBERS

年度 Year	參加戶數 DHI Farms	乳樣數 Sample numbers	頭數 Cow numbers
2011	191	188,133	26,486
2012	180	181,334	26,227
2013	167	170,680	24,870
2014	164	179,715	25,706
2015	169	185,804	26,902
2016	172	195,447	27,209
2017	179	192,924	28,071
2018	178	189,844	28,485
2019	174	192,149	27,981

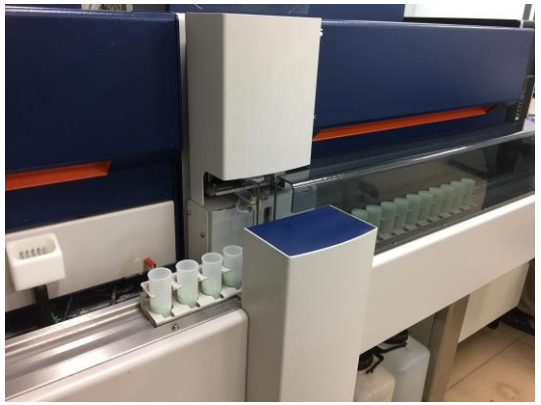
畜試所牛乳檢驗室參與畜政聯盟 (ICAR) 能力試驗 (PT)
TLRI PARTICIPATE IN ICAR PROFICIENCY TEST

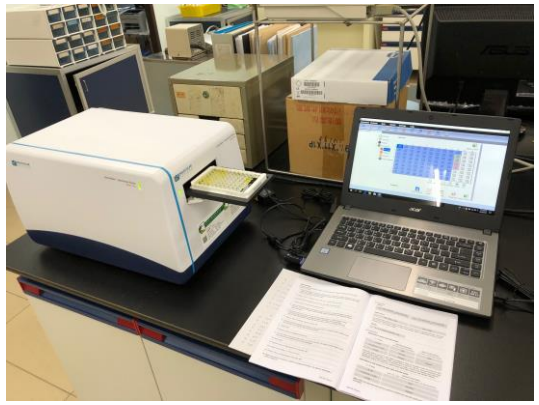
- 參與 PT 項目:脂肪、蛋白質、尿素氮、體細胞數、乳糖、羥基丁酸、懷孕相關醣蛋白及乳房炎病菌原

The PT parameters considered in the ICAR PT are: fat, protein, urea, somatic cell, lactose, Beta-Hydroxybutyric (BHB), Pregnancy Associated Glycoproteins (PAG), microorganisms & bacteria DNA (PCR techniques)

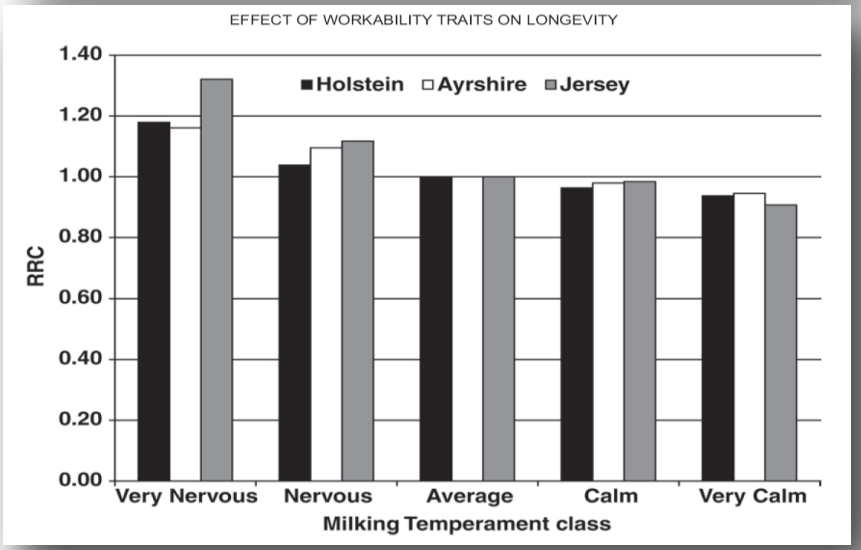
- PT 結果均獲得 Good 最高評價

TLRI milk laboratory received the highest rating of Good





國際種公牛後裔女兒牛性能評估年曆
PORTFOLIO OF INTERBULL EVALUATIONS



RRC: Relative risk of culling

Sewalem *et al.*, 2010

Portfolio of Interbull evaluations
國際種公牛後裔女兒牛性能評估年曆

1995	Production						
1999	Production	Type					
2001	Production	Type	Cellcount				
2004	Production	Type	Cellcount	Longevity			
2005	Production	Type	Cellcount	Longevity	Calving		
2007	Production	Type	Cellcount	Longevity	Calving	Fertility	
2008	Production	Type	Cellcount	Longevity	Calving	Fertility	Workability

乳量乳質—體型—體細胞數—高繁—產犢順—易懷孕—好擠乳

國際畜政聯盟
乳牛性能分項

International information

Cross-reference list
Interbull Cross-reference lists of bulls with multiple registrations

Production 乳量乳質
Evaluation summaries for production traits

Conformation 體型
Evaluation summaries for conformation traits

Udder health 體細胞數
Evaluation summaries for udder health traits

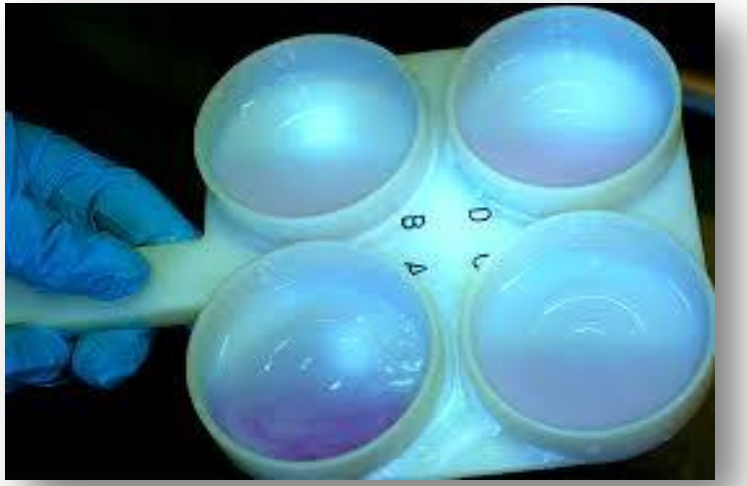
Direct longevity 高繁
Evaluation summaries for direct longevity traits

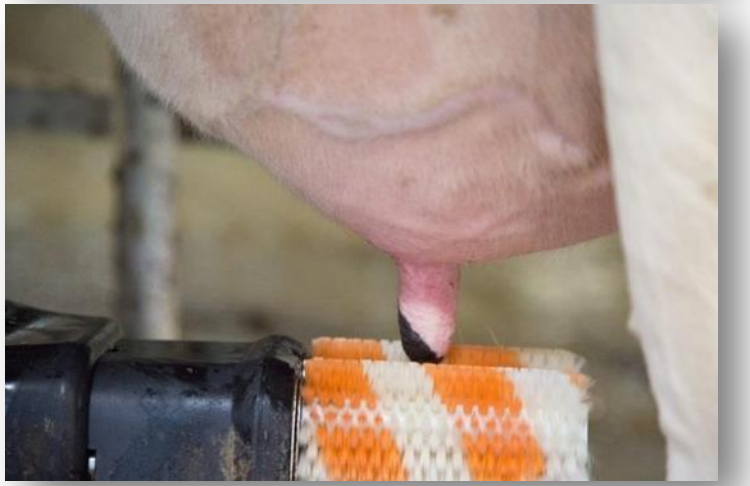
Calving Traits 產犢順
Evaluation summaries for calving traits

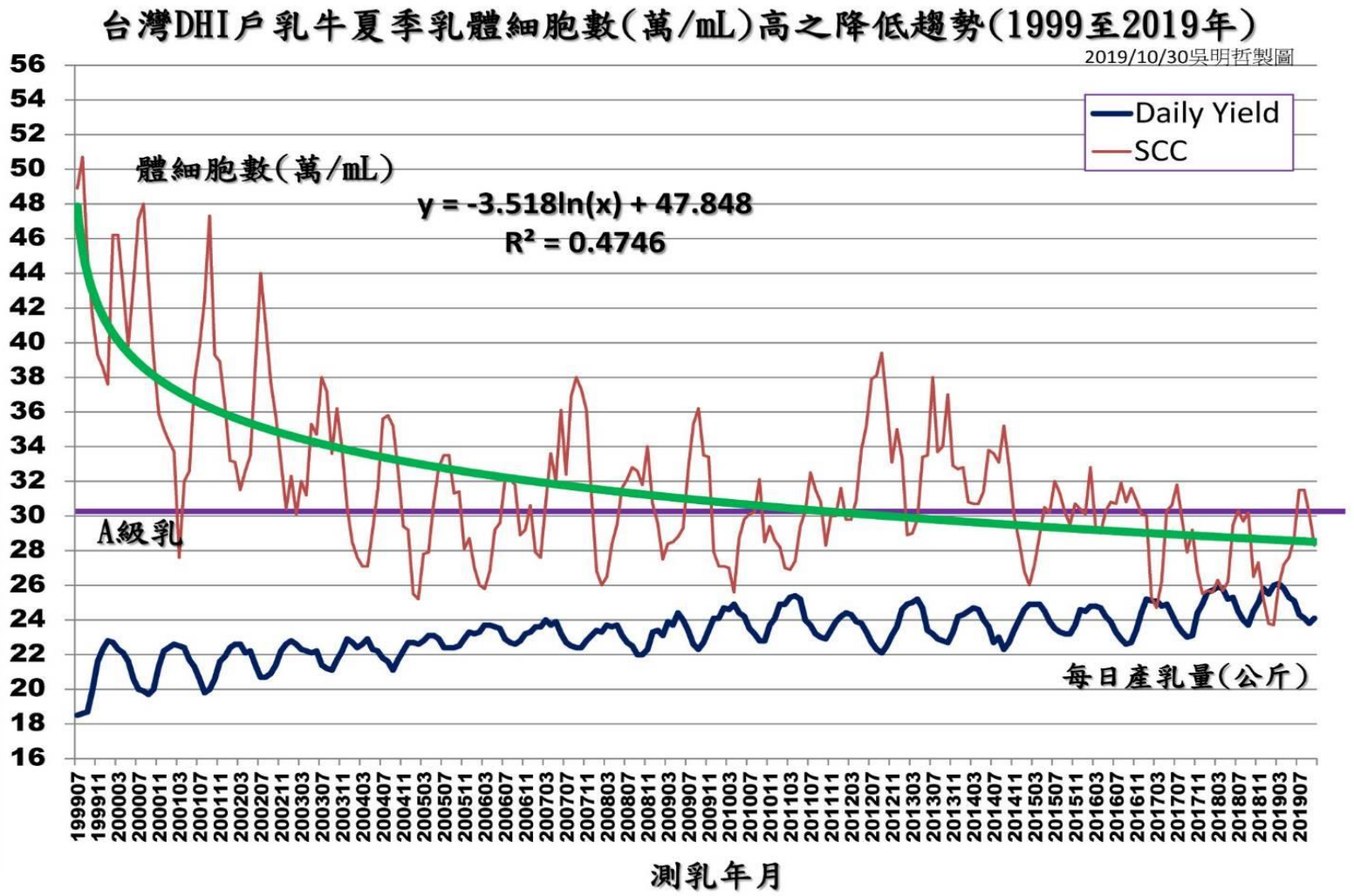
Female Fertility 易懷孕
Evaluation summaries for female fertility traits

Workability 好擠乳
Evaluation summaries for milking speed and temperament

臺灣近二十年DHI戶乳牛夏季乳體細胞數變化
THE CHANGE OF DHI HERD MILK SOMATIC CELL COUNTS DURING SUMMER IN THE PAST TWO DECADES



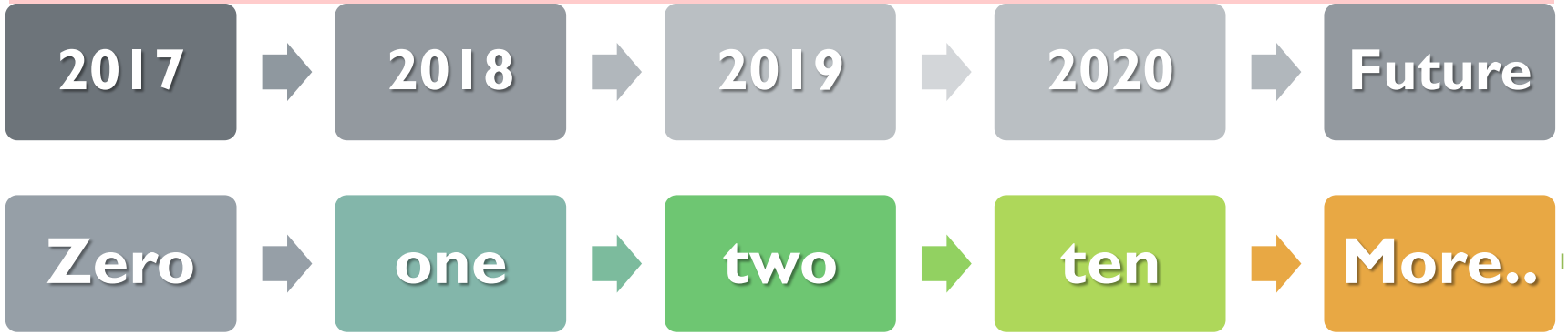




臺灣近三年乳牛產業的變化
THE CHANGE OF TAIWAN'S DAIRY INDUSTRY IN THE PAST THREE YEARS

年度 Year	乳牛場數 No. dairy farm	總牛頭數 No. dairy cow	泌乳牛頭數 No. milking cow	年生乳產量 (tons/year) Average milk production
2017	553	111,376	60,523	386,362
2018	553	113,978	61,967	419,342
2019	559	116,025	61,813	431,879

使用機器人擠乳機乳牛場數
No. of dairy farms using Robot milking machines



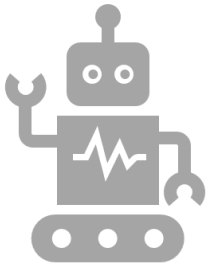
擠乳設備趨勢與議題
CURRENT TRENDS AND ISSUES

- 愈來愈多酪農使用自動化擠乳設備可自動收集個別牛隻產乳量

A growing number of herd owners are moving to robotic milking systems or other forms of automation that record daily milk weights for each cow

- 甚至，有些自動化設備提供即時之乳成分或體細胞數分析功能

In addition, some automated systems also provide results from in-line analysis of milk components and/or somatic cell



- 多數酪農都認為這些設備提供的資料應被納入泌乳紀錄中

Producers perceive this data to be accurate and feel it should be incorporated into the calculation of lactation records

Canadian Dairy Network, 2016

自動化擠乳設備自動收集每日個別牛隻產乳量、乳組成…
ROBOTIC MILKING SYSTEMS OR OTHER FORMS OF AUTOMATION THAT RECORD DAILY MILK WEIGHTS AND COMPONENT FOR EACH COW

脂肪、蛋白質、尿素氮、體細胞數、乳糖、羥基丁酸…..
Fat, Protein, Urea, Somatic cell, Lactose, Beta-Hydroxybutyric (BHB)…..

擠乳設備趨勢與議題
CURRENT TRENDS AND ISSUES

- **DHI 服務因為機器人產生不同價值**

Robotic Herds See Value in Different Aspects of DHI Services

- **透過 DHI 不僅是機器人牧場，可以了解所有牧場的水準，明白自身的定位**

With DHI we can benchmark and see what our strengths and weaknesses are over all farms, not just robot farms (Steve Oosterhof, JOBO Farms)

- **獸醫及營養師認為 DHI 資料為與牛群溝通之重要語言**

DHI is the language and format that my vet and nutritionist work with, so it was important to continue with that

From the DHI Catalyst, December 2014

美國乳牛群性能改進協會自動化擠乳設備採樣流程
DHIA SAMPLING FOR AUTOMATIC MILKING SYSTEM(ROBOTIC) PROCEDURES

- 採樣日 24 小時內必需將乳量資料回傳 DHI

Test day milk weights will be obtained as 24-hour yield obtained from the automatic (robotic) milking system software

- 24 小時平均乳量計算基礎為至少連續三天但最多不超過十天之資料

The average 24-hour milk yield reported should represent a minimum of three consecutive days and not to exceed ten consecutive on milk yields

- 不提供上下午乳樣之乳量檢測結果

There will be no application of AM/PM factors on milk yields

DHIA, 2017

泌乳紀錄來源之替代可能
ALTERNATIVE STRATEGY FOR LABELLING LACTATION RECORDS

- 乳樣採集設備必需經由 DHIA 認可才准許於採樣時使用

Milk samples shall be obtained using DHIA accepted sampling devices for one of milkings during the test days

- 不提供上下午乳樣之乳成分檢測結果

There will be no application of AM/PM factors on milking component results

- 自動化擠乳設備之乳量及乳成分結果，不可用於遺傳表現評估，除非設備通過 DHIA 現場及遠端測試認證

Data obtained from automatic(robotic)milking system software may not be used in genetic evaluations unless the system meets National DHIA/Quality Certification Services standards for on-farm, in-line analyzers

DHIA, 2017

乳量計之檢測認證及指南
GUIDELINES FOR TESTING, APPROVAL AND CHECKING OF MILK RECORDING DEVICES

Section 11 - Guidelines for Testing, Approval and Checking of Milk Recording Devices

Section 11 – Milk Recording Devices
Version October, 2017

- 自動擠乳系統

Automatic milk recording systems

- 自動擠乳記錄系統是自動記錄牛乳產量和自動採樣 / 自動牛乳分析的組合

An automatic milk recording system is a combination of automatic recording of milk production and automatic sampling / automatic milk analyses

- 自動擠乳紀錄系統是結合多種樣態的乳量計，每個組成細節都必需通過驗證

In case the automatic sampling system is combined with more types of milking systems and/or more types of milk meters, each combination has to be tested for approval

符合 ICAR 定期檢測之認證乳量計
PERIODIC CHECKING OF APPROVED METERS

- **Afifree Milk Meter**
- **Afikim Milk Meters also called Fullflow, Manuflow, Sureflow, Afikim/Combina**
- **Bou-Matic M+ Milk Meter**
- **Boumatic Perfection 3000 and Boumatic Smartcontrol Meter**
- **Dairy Manager Milk Meter**
- **Dairymaster Weighall Milk Meter**
- **Lely MWS**
- **SCR Free Flow Meters**
- **VMS System Delaval milk meter MM25**

ICAR THE GLOBAL STANDARD FOR LIVESTOCK DATA

Annex 10 of Section 11 of the ICAR Guidelines. Periodic checking of approved meters. Hints for the sample taker and farmer

Annex 10/11. Periodic Checking of Meters
Version October, 2017

使用自動乳量 (質) 計在記錄過程中需調校認可設備之測試程序：
THE TEST PROCEDURE FOR APPROVAL OF MILK RECORDING DEVICES IS ADJUSTED TO THE SITUATION WITH AUTOMATIC MILK RECORDING SYSTEMS ON THE FOLLOWING POINTS:

- 自動乳量 (質) 計為認證設備則資料可直接被利用

In case the milk meter used in automatic milk recording is of an already approved type, the laboratory test is omitted

- 牧場將由 ICAR 測試中心從製造商/測試申請人或經銷商提供的農場列表中選擇，至少需通過在 2 個牧場 10 個牛乳記錄 / 採樣設備系列之測試

The test will be carried out by testing 2 out of a series of at least 10 milk recording/sampling devices. Both devices should be tested in two milk recorded herds. The farms will be chosen by the ICAR test centre from a list of farms given by the manufacturer/test applicant or dealer

- 對於自動（自願）乳量 (質) 系統戶，設備測試將作為牧場日常擠乳程序的一部分進行

In the case of automatic (voluntarily) milking systems, the device tests will be carried out as part of the normal daily milking routine of the chosen farms

美國荷蘭牛協會機器人擠乳紀錄計畫
HOLSTEIN ASSOCIATION USA ROBOTIC MILKING RECORDS PROGRAM

- 此項新計畫針對，想持續記錄其牧場牛群資料及產能之使用機器人擠乳設備酪農，且便於將後裔資料登錄於協會

A new program for producers with robotic milking systems who no longer are participating in traditional milk recording programs but still wish to have their production information published on Official Holstein Pedigrees

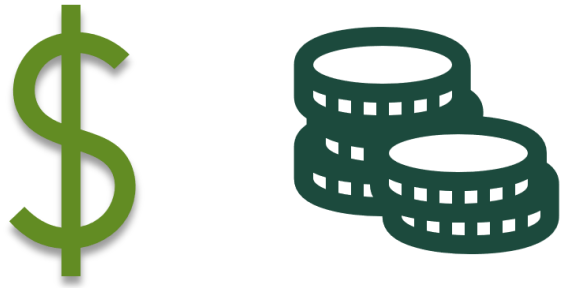
- 我們很榮幸將新的服務介紹給使用機器人的酪農，藉此可將機器人與 **DHI** 資料串連

"We're pleased to be able to offer a new service to dairies with robotic milking systems, so they can streamline their milk weights and component information to help them manage their herds," said Holstein Association USA CEO John M. Meyer.

美國荷蘭牛協會機器人擠乳紀錄計畫
HOLSTEIN ASSOCIATION USA ROBOTIC MILKING RECORDS PROGRAM FEE

- 參加 TriStar AMR 之牛群紀錄費用為每月 17 美金，另加上為已登記的荷蘭乳牛記錄 305 天泌乳期資料費用為 2 美金，包括數據收集和處理及將資料匯入 HAUSA牛群記錄系統

The fees to participate in TriStar AMR are a $17 per month herd fee, plus $2 per completed 305-day lactation recorded that is loaded for Registered Holstein cows, which covers data collection and processing by ATA, and loading into the HAUSA herdbook system



HAUSA's TriStar program, 2018

自動化擠乳設備引領更好之育種
BETTER BREEDING WITH AUTOMATED MILKING SYSTEMS

- 資料收集機會

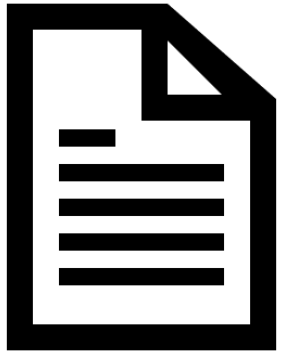
Data Collection Opportunity

- 乳樣紀錄的挑戰

Milk Recording Challenge

- 電腦串聯

Computer Compatibility



Blair Murray, 2010

自動化擠乳設備引領更好之育種
BETTER BREEDING WITH AUTOMATED MILKING SYSTEMS

- 朝適用自動化擠乳設備性狀育種 (出乳速度、乳房結構、乳頭位置形狀..)

Breeding For AMS Traits (milking speed, udder conformation, teat placement and shape)

- 其他 (牛隻體重、反芻次數、孕酮、乳酸脫氫酶、尿素氮、Beta 羥基丁酸..)

Even More Information(live weight, chewing activity, progesterone, LDH and BHB

Blair Murray, 2010

結論
CONCLUSION

- 自動乳量 (質) 計記錄帶來資料收集的便利性，但持續測試校正才能維持設備之準確度

Automatic (voluntarily) milking systems bring a easy way to data collection, but the device testing and calibration will be carried out as part of the normal daily milking routine of the chosen farms

- 機器人 (自動乳量乳質紀錄) 將成為新趨勢，但無論是畜群管理決策亦是長期育種決策，DHI 仍是乳牛場成功運營不可或缺的一部分

Whether it is for herd management decisions or longer term genetic improvement, DHI continues to be an integral part of the success of dairy operations, even as they make a transition to modern robotic milking systems

THANK YOU