出國報告（出國類別：研究）

國際化跨域創新與科研產業化人才培育

服務機關：行政院農業委員會畜產試驗所

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派赴國家/地區：馬來西亞

出國期間：民國 **107** 年 **7** 月 **31** 日至 **8** 月 **5** 日

報告日期：民國 **107** 年 **9** 月 **26** 日

摘要

亞澳畜產大會（Asian-Australasian Animal Production Congress，AAAP）成立於西元 1980 年，每二年舉辦一次，2018 年 8 月 1 日至 4 日於馬來西亞古晉舉辦第 18 屆亞澳畜產大會，此次會議來自亞洲及澳洲等 19 個會員國及 600 多位學者及專家參加及發表。馬來西亞已於第 1 屆（1980 年）和第 11 屆（2004 年）舉辦「亞澳畜產大會」，第 18 屆（2018 年）會議是第三次舉辦，因此，馬國政府及畜產界相當重視此次會議，開幕儀式婆羅州州長也親自蒞臨歡迎餐會。本次會議畜產試驗所由黃振芳所長帶領 9 位研究同仁出席，並展示本所研究的成果及吸收新知俾利規劃未來研究方向。

本次會議來自亞洲及澳洲等國之 600 多位研究學者，共發表高達 549 篇研究報告，此次會議舉辦相當成功。第 18 屆 AAAP 大會邀請馬來西亞 Dr. Quaza Nizamuddin 擔任大會開幕講者，其主題為“Global Livestock Production in Challenging Environment”，針對全球暖化問題，全球畜牧產業正面臨問題及因應策略。本次會議由各國研究學者及學生參與，大會有 13 題前瞻性議題報告，另針對動物營養、動物生理、動物育種、肉品加工、經營管理及生物科技等 18 個主題，學者可依照不同領域聽取有興趣研究成果。本所研究同仁共有 9 題報告，包含 7 題海報展示和 2 題口頭報告，同仁藉此次會議了解國際研究狀況及成果，增加本所研究能量，藉由參與國際會議機會，擴展研究視野及學術交流，增加臺灣研究軟實力，對我國新南向政策頗有幫助。

畜產試驗所黃振芳所長亦以中國畜牧學會理事長的身份參加理事長會議(Council Meeting)，並進行國家報告(country report)，會議決議 2020 年第 19 屆 AAAP 由菲律賓主辦，大會籌備委員會主席為該國水牛研究所所長 Dr. Arnel del Barrio, 該研究所與畜產試驗所合作關係非常密切，建議到時我國學術界可以結合產業組團參加，並在會場設立台灣攤位，積極推展我國農業強項，佈局新南向。本次會議後，亦由當地華僑安排參訪乳牛、鴨及雞產業，砂勞越獸醫部門主管 Dr. Adrian Susin Ambud 及畜牧業者皆表達高度與我國合作的意願，建議可整合國內畜牧飼養管理、飼料添加物、畜牧設施及設備業者等組成團隊，把當地華僑或留學台灣人士所經營的事業體當成新南向合作的切入點，創造雙贏商機。

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壹、目的

2018 年(第 18 屆)亞澳畜產大會(Asian-Australasian Animal Production Congress, AAAP)在馬來西亞的沙勞越(Sarawak)之古晉城(Kuching) 舉行（圖 1)，大會共有 19 個會員國參加，600 多位學者及專家參與（圖 2)，共發表了 378 篇海報報告論文及 171 篇口頭報告論文，大會也邀請 19 位畜牧產業各領域的專家擔任 Keynote speaker 及 Plenary speaker，藉由各領域傑出專家的報告（圖 3-4)，讓與會人員了解目前世界畜牧產業發展之近況與方向。

此次會議中之論文共區分 18 個領域小組，包括 Non-Ruminant Nutrition、Animal Physiology、Meat Science、Ruminant Nutrition、Animal Health、Socioeconomics、Biotechnology、Animal Reproduction、Livestock Industry、Environmental Issues、Forage Science、Swiftlet Symposium、Animal Breeding、Feed Technology、Crop-Livestock Integration、Aquaculture、Feed Technology Silage 及 Dairy Science 等 18 領域。

本次舉辦地點為馬來西亞古晉城，此地區為熱帶區域，盛產棕櫚粕的國家，大會邀請印尼 Prof. Abdul Razak Alimon 主講「Palm Kernel Expeller in Poultry Diets: Is it the Right Move?」，棕櫚粕為棕櫚仁脫殼榨油後的副產品，可作為動物性飼料，依報告資料顯示，棕櫚粕主要生產國為印尼及馬來西亞二國，2014 年其二國生產量分別約 4.5 及 2.5 百萬噸，主要出口至紐西蘭，約占二國出口量之 33.2 及 30%。棕櫚粕成分為乾物質 94%，粗蛋白質

含量 14-21%，總能 4.998 Mcal/kg，代謝能 1.7-2.5 Mcal/kg，粗纖維含量 21-23%，棕櫚粕在各動物使用情形，建議使用量不超過飼糧 10-15%，因其粗纖維含量高及適口性較差，且能量和粗蛋白質利用性差，直接影響該原料使用量，一般反芻動物使用量較高，反之，於單胃動物則受限其使用量（圖 5-6）。

韓國首爾大學 Prof. Yoo Yong Kim 主講「Strategic Feeding and Nutrition in Monogastric Animal」，動物採食量與能量攝取有密切關係，當動物增加能量攝取量則降低採食量，此議題相當有趣，關連原料及飼糧適口性，台灣對此議題研究不多，在動物換料或原料評估其適口性，如動物對給予適口性不佳飼糧則影響動物生長性能，嚴重導致消瘦或死亡。針對動物飼料風味評估方式為味道、嗅覺及口感（Flavor=Taste + Olfaction + Mouth feel），如能在動物受環境及管理緊迫時，增加一些適口性佳動物添加物，提升動物採食量，則對腸道發育具有正面效果，其建議夏季高溫時，可使用各類具有甜類添加物，其中較廣泛使用葡萄糖及果糖等，這對養豬產業則相當重要，仔豬離乳過程中，當仔豬因離乳過程採食量不佳，直接影響腸道發育及生長表現差，間接導致仔豬抵抗力變差，疾病則趁機進入，仔豬於保育期飼養則出現問題，當仔豬腸道因採食變差受損，其需長時間恢復，如能解決此問題，可提升保育豬隻育成率。因此，開發仔豬適口性佳之配方對養豬產業則相當重要（圖 7-8）。

今年大會主題為全球畜產在環境的挑戰之議題，全球氣候暖化造成農業生產挑戰、農業循環經濟與在地生產等問題，各國積極利用在地副產物作為芻料作物，如油棕(Oil palm)副產物、樹薯(Cassava)、廢棄菇類基質(Spent mushroom substrate)、全株稻稈青貯(Whole crop rice silage)與豆腐渣(Tofu waste)等相關副產品，有些副產品調配過程會添加乳酸菌屬(*L. plantarum*; *P. aeruginosa*; *S. cerevisiae*; *A. baumanni*)以提升其消化率與適口性，利用農業副產物做為青貯料，可降低反芻動物飼養成本。臺灣進口國外乾草約占整體需求量約 50-55%，國內研發機構需有效利用副產物及建立國產芻料調製技術，以取代進口芻料。

本次與會使我們瞭解全球暖化問題，畜牧產業正面臨問題及因應策略等議題，值得研究人員深思及探討。各領域討論之議題與本所業務均有相關，且內容相當充實，僅能於有限的時間內就各重點主題節錄相關之議題，建議若經費許可，未來可考慮擴大派員參與，以蒐集及瞭解更多國際間之新資訊及重要發展。

貳、過程

107 年 7 月 31 日至 8 月 3 日第 18 屆亞澳畜產大會假於馬來西亞古晉婆羅洲會議中心(Borneo Convention Centre)舉辦為期 4 日之研討會，8 月 4 日為技術參訪行程。

本次參與人員規劃行程表如下

AAAP 2018 CONGRESS
GLOBAL LIVESTOCK PRODUCTION IN CHALLENGING ENVIRONMENT

31ST JULY 2018 (TUESDAY)						
1430 – 1830	**CONFERENCE REGISTRATION & SUBMISSION OF SPEAKERS' PRESENTATION** Riverside Majestic Hotel Astana Wing, Kuching					
1ST AUGUST 2018 (WEDNESDAY) – DAY 1						
0730 – 0830	**CONFERENCE REGISTRATION & SUBMISSION OF SPEAKERS' PRESENTATION** Concourse, Borneo Convention Centre, Kuching					
0830 – 0845	**WELCOME SPEECH** *Organising Chairman of the AAAP 2018 Congress* Hall A					
0845 – 0945	**KN1**: Future Global Livestock Production in Challenging Environment *Quaza Nizamuddin, H. N.* Hall A					
0945 – 1045	**POSTER SESSION 1 & TEA BREAK** Rooms 12, 13 & 14					
1045 – 1145	**KN2**: The Digital Future: The Role of 'Big Data' for Agricultural Development in the Region *Thomson, P. C.* Hall A					
1145 – 1215	**PL1**: Buffalo Production in the Philippines amidst Climate Change *del Barrio, A. N.* Hall A					
1215 – 1330	**LUNCH** Hall B & C					
	Hall A ***Non-Ruminant Nutrition***	**Hall D** ***Animal Physiology***	**Room 2 & 3** ***Meat Science***	**Room 4 & 5** ***Ruminant Nutrition***	**Room 8 & 9** ***Animal Health***	**Room 10 & 11** ***Socioeconomics***
1330 – 1345	**PL2**: Palm Kernel Expeller in Poultry Diets: Is it the Right Move? *Alimon, A. R.*	**PL3**: Challenges in Livestock Production: Moving on from the Five Freedoms *Sumita, S*	MS1	RN1	**PL4**: Immunological Approaches to Maximize Livestock Productivity *Yun, C-H.*	**PL5**: Development of Beef and Dairy Industries in Indonesia: Government's Initiative and Future Directions *Agus, A.*
1345 – 1400			MS2	RN2		
1400 – 1415	NRN1	AP1	MS3	RN3	AH1	SE1
1415 – 1430	NRN2	AP2	MS4	RN4	AH2	SE2
1430 – 1445	NRN3	AP3	MS5	RN5	AH3	SE3
1445 – 1500	NRN4	AP4	MS6	RN6	AH4	SE4
1500 – 1515	NRN5	AP5	MS7	RN7	AH5	SE5
1515 – 1530	NRN6	AP6	MS8	RN8	AH6	SE6
1530 – 1545	NRN7	AP7	MS9	RN9	AH7	SE7
1545 - 1600	NRN8	AP8	MS10	RN10	AH8	SE8
1600 – 1700	**POSTER SESSION 1 & TEA BREAK** Rooms 12, 13 & 14					
1700 – 1830	**PRE-DINNER NETWORKING SESSION** Concourse, Borneo Convention Centre, Kuching					
1900 – 2200	**CONGRESS OPENING CEREMONY & SARAWAK STATE HOSTED DINNER** Hall B & C					

2ND AUGUST 2018 (THURSDAY) – DAY 2						
0745 - 0845	**CONFERENCE REGISTRATION & SUBMISSION OF SPEAKERS' PRESENTATION** Concourse, Borneo Convention Centre, Kuching					
0845 – 0915	**PL6**: The Global Current Status in the Animal Reproduction and Biotechnology for Improving Livestock Production in the Near Future *Sato, E.* Hall A					
0915 – 0945	**PL7**: The Use and Misuse of Antibiotics in the Developing World *Wynn, P. C.* Hall A					
0945 – 1015	**PL8**: Sustainability of Bird Nest Resources and Production to Meet Global Demand *Babji, A. S.* Hall A					
1015 – 1115	**POSTER SESSION 2 & TEA BREAK** Rooms 12, 13 & 14					
	Hall A	**Hall D**	**Room 2 & 3**	**Room 4 & 5**	**Room 8 & 9**	**Room 10 & 11**
	Non-Ruminant Nutrition	***Biotechnology***	***Animal Reproduction***	***Ruminant Nutrition***	***Livestock Industry***	***Environmental Issues***
1115 – 1130	NRN9	BT1	AR1	RN11	**PL9**: Opportunities of Livestock Industry in Challenged Environment *Li, D.*	EI1
1130 – 1145	NRN10	BT2	AR2	RN12		EI2
1145 – 1200	NRN11	BT3	AR3	RN13	LI1	EI3
1200 – 1215	NRN12	BT4	AR4	RN14	LI2	EI4
1215 – 1230	NRN13	BT5	AR5	RN15	LI3	EI5
1230 – 1330	**LUNCH** Hall B & C					
	Hall A	**Hall D**	**Room 2 & 3**	**Room 4 & 5**	**Room 8 & 9**	**Room 10 & 11**
	Non-Ruminant Nutrition	***Biotechnology***	***Animal Reproduction***	***Forage Science***	***Swiftlet Symposium***	***Animal Breeding***
1330 – 1345	**PL10**: Future Applications of Insects as an Alternative Protein Source for Human and Livestock Nutrition *Henuk, Y. L.*	BT6	AR6	FS1	SSym1 SSym2 SSym3 SSym4 SSym5	AB1
1345 – 1400		BT7	AR7	FS2		AB2
1400 – 1415	NRN14	BT8	AR8	FS3		AB3
1415 – 1430	NRN15	BT9	AR9	FS4		AB4
1430 - 1445	NRN16	BT10	AR10	FS5		AB5
1445 – 1500	NRN17	BT11	AR11	FS6		AB6
1500 – 1515	NRN18	BT12	AR12	FS7		AB7
1515 – 1530	NRN19	BT13	AR13	FS8		AB8
1530 – 1630	**POSTER SESSION 2 & TEA BREAK** Rooms 12, 13 & 14					
FREE & EASY						

3RD AUGUST 2018 (FRIDAY) – DAY 3						
0730 – 0830	**CONFERENCE REGISTRATION & SUBMISSION OF SPEAKERS' PRESENTATION** Concourse, Borneo Convention Centre, Kuching					
0830 – 0900	**PL11**: Animal Welfare during Transport: Still A Major Problem! *Zulkifli, I.* Hall A					
0900 – 0930	**PL12**: Nutrients Affecting Feed Intake of Livestock *Kim, Y. Y.* Hall A					
0930 – 1000	**PL13**: New Concept: From Practical Monogastric Animal Management to Greenhouse Gas Production *Hsia, L. C.* Hall A					
1000 – 1100	**POSTER SESSION 3 & TEA BREAK** Rooms 12, 13 & 14					
	Hall A	**Hall D**	**Room 2 & 3**	**Room 4 & 5**	**Room 8 & 9**	**Room 10 & 11**
	Non-Ruminant Nutrition	***Ruminant Nutrition***	***Socioeconomics***	***Feed Technology***	***Crop-Livestock Integration***	***Aquaculture***
1100 – 1115	NRN20	RN16	**PL14**: Livestock and Poultry Production in Cambodia: Challenges and Opportunity Seng, M.	FT1	**PL15**: Livestock Integration in Oil Palm Plantation: Potential and Limitation *Daud, A.*	AQ1
1115 – 1130	NRN21	RN17		FT2		AQ2
1130 – 1145	NRN22	RN18	SE9	FT3	CLI1	AQ3
1145 – 1200	NRN23	RN19	SE10	FT4	CLI2	AQ4
1200 – 1330	**LUNCH & FRIDAY PRAYERS** Hall B & C					
	Hall A	**Hall D**	**Room 2 & 3**	**Room 4 & 5**	**Room 8 & 9**	**Room 10 & 11**
	Feed Technology-Silage	***Animal Physiology***	***Meat Science***	***Livestock Industry***	***Animal Health***	***Dairy Science***
1400 – 1415	FTS1	AP9	MS11	**PL16**: Interaction of Climatic Factors with Production and Reproduction of Livestock and Poultry in Bangladesh *Khan, M. K. I.*	AH9	DS1
1415 – 1430	FTS2	AP10	MS12		AH10	DS2
1430 – 1445	FTS3	AP11	MS13	LI4	AH11	DS3
1445 – 1500	FTS4	AP12	MS14	LI5	AH12	DS4
1500 – 1515	FTS5	AP13	MS15	LI6	AH13	DS5
1515 – 1530	FTS6	AP14	MS16	LI7	AH14	DS6
1530 – 1630	**POSTER SESSION 3 & TEA BREAK** Rooms 12, 13 & 14					
1630 – 1730	**CLOSING CEREMONY & AWARD PRESENTATION** Hall A					

參、心得與建議

大會議題涵蓋18個領域，海報開放展示時間為每日上午及下午二個時段，各國研究人員可了解研究方向及與展示學者進行交流，謹就與本所業務較為相關之重要內容及同仁參加後心得舉列。

一、 心得概要

（一）口頭發表論文：

1、主題一：「Evaluation of boar semen quality by WST-8 assay」

（報告者：林秀蓮助理研究員）（圖 9）

比較 WST-8 酵素還原反應法、流式細胞儀 (FC) 和電腦輔助精子活力分析系統 (CASA) 之結果，用以建立 WST-8 酵素還原反應法於分析豬精液品質。試驗結果顯示，豬精液濃度為 300×10^6cells/mL 時，以 WST-8 分析測定效果最佳。WST-8 還原率與精子存活率、頭帽完整性、粒線體完整性及精子活力具高度相關性，且相關係數與反應時間成正比。上述結果顯示，WST-8 酵素還原反應法可用以評估公豬精液品質。

2、主題二：「Moving towards agricultural 4.0 in Taiwan with smart technology of top five robotic applications in dairy cattle farm」

（報告者：吳明哲組長）（圖 10）

台灣智慧農業 4.0 科技導引乳牛場建置五大動線機器人，進行人機輔具作業環境建置及智慧化管理乳牛場，催生我國新型態之智慧

型機器人上線來替代酪農戶人工，進行(1)每日擠乳動線、(2)每日餵養牛隻動線、(3)每日清理牛隻糞尿及環境整潔動線、(4)週期管理母牛分娩及仔牛飼養動線、(5)週期監測牛隻健康動線等五大日常工作動線替代勞力。本研究選定 20 家種牛場導入智慧型五大動線機器人及其感測系統，建置機器人示範場域，從推料餵養、擠牛乳、哺育仔牛到牛舍地面整潔管理模式更動。智慧型機器人上線來替代人工的研究資料顯示種牛場已能建構省工、省時及精準之全方位生乳生產模式，讓乳牛產業升級及產出高品質的牛乳。

（二）海報展示

本屆亞澳畜產大會發表文章，內容闡述本所研發成果及技術創新等（本所共發表 9 篇詳如圖 11-16），並節錄有關研究成果及心得。

1、本所林正斌研究員兼組長和李姿蓉助理研究員一同與泰國學者 Dr. Mapato 討論其試驗中的狼尾草品種「Mahasarakham」之特性，該品種屬於矮莖型，在當地使用約 10 年，又名甜牧草(Sweet grass)，粗蛋白質含量高達 14.7%，酸洗纖維 33.1%，中洗纖維僅 55.7%，適合青飼或青貯餵飼乳牛。李姿蓉助理研究員一併向 Dr. Mapato 展示本所選育的 7 個狼尾草品種特性，由於 Dr. Mapato 並非該品種的育種者，也不清楚此品種的來源及泰國植物種源交換之相關規定，故相互交換名片再進一步聯絡，可供未來雙方合作或互訪方式。回國後，搜

尋“Mahasarakham”相關文獻，該品種再生 10 個月後，株高僅 132cm，葉莖乾物比 1.68，每公頃每次可收割約 39 公噸的鮮草，其生長緩慢，葉片多等特性與本所選育之狼尾草台畜草三號特性相似，推論狼尾草品種“Mahasarakham”和狼尾草台畜草三號應屬同個親本，均來自美國的“Merkeron”和 “Mott”。

2、日本研讀學位的埃及 Ms. Fitri 和 Ms. Mousa 二位女士，分別提出利用日本柿餅副產物—柿皮青貯之調製方法及利用。試驗緣由是要處理大量的農副產物—柿皮，日本年產 30 萬公噸的柿子，包含作為鮮果的甜柿和柿餅的澀柿，每年產出近數千公噸的柿皮，小農可作堆肥處理，大型加工廠產出的柿皮如何處理則是一大問題，柿皮含有丹寧(Tannin)和高含水率，待解決後，未來將進行動物試驗。臺灣一樣也有農副產物處理及生產過剩的問題，畜試所曾接手多樣蔬菜和水果的青貯任務，也因蔬果水分含量過高須添加玉米粉或麩皮等吸水物質，在此次會議中第一次遇到利用農副產物—柿皮製作青貯，更要瞭解蔬果的二次代謝物成分和含量是否對經濟動物有害，之如國產愛文芒果皮，雖含有花青素等有益物質，但對於患有乳糖不耐症者易造成傷害，或無法透過青貯等調製降低有害物質的含量，則須謹慎小心其飼糧比例。由於柿子等有生產季節限制，無法全年供應，在畜牧場動物營養管理上更需周詳規劃。

3、馬來西亞大學動物科學系 Dr. Jusoh 嘗試開發豆科牧草作為兔芻料，

將野生花生(*Arachis pintoi*)、山珠豆(*Centrosema pubescens*)和尖葉木藍(*Indigofera zollingeriana*)三種豆科植物混合，生產具高營養價值之兔隻芻料，若未來要開發成兔隻的完全日糧，仍需與其他飼料原料調製成粒狀飼料，以符合兔隻營養需求。另有學者以辣木(*Moringa oleifera*)作為牧草的開發。臺灣因氣候無法使苜蓿全年生長或多年生，只能在秋和冬季較乾冷的季節種植，畜牧業對豆科牧草的需求，只能依賴進口。目前已收集臺灣各種豆科植物性狀及營養成分。礙於生產成本和栽培土地等考量，因此自我限制發展，建議牧草生產朝向粗放生產再加工成精緻產品，利用在地豆科植物開發不同種類和形態的飼料，不侷限在乾草或青貯調製利用上。

4、印度洋地區的氣候改變及聖嬰氣候現象的衝擊力道，造成印尼等地帶來嚴重乾旱。印尼學者假設在乾旱時期，無法生產玉米等原料，藉由稻穀、銀合歡、田菁或南洋櫻(*Grilicidia sepium*)等取代玉米用量及調整肉牛隻飼養模式，可因應氣候變遷之缺糧現況。

5、在巴基斯坦，Mr. Ullah 探討羅滋草(Rhodes grass)在巴基斯坦栽培的試驗，收集當地不同播種密度和割期下之鮮草產量及農藝性狀等資料，顯示較高的播種密度可獲得較佳的牧草品質和產量。臺灣早年也有引進羅滋草，經評估並不適合臺灣市場需求，單位面積產量不足抵銷生產成本，而在巴基斯坦是良好的牧草種類，因此在開發某種植物作為牧草作物，除評估其營養價值和產量外，應以當地氣候

及土壤條件開發適合栽培管理模式，這些是需要持續探討。

6、台灣經濟動物之芻料來源包括青刈玉米、狼尾草、盤固草、尼羅草及豆科牧草-苜蓿等，這些芻料自給率不到 60%，其中仍大部分需仰賴進口，面臨氣候環境變遷情況下，不管是人類之糧食或牲畜之芻料都越來越短缺，善加利用農糧作物、蔬果及其副產物或格外品作為經濟動物之芻料來源，以補充飼糧短缺及未來重要的研發方向。

7、本所生理組林秀蓮助理研究員應用 Percoll 梯度離心法分離品質優、劣之雞精子，並比較單層及雙層 Percoll 之分離效果。結果顯示，應用單層 Percoll 70、Percoll 80 和 Percoll 90 於公雞精子分選效率優於雙層 Percoll 35/70、Percoll 40/80 和 Percoll 45/90。

8、本所生理組陳裕信助理研究員主要是探討優化蘭嶼豬的超數排卵處理方法，研究顯示，依蘭嶼豬體重與施打不同劑量之 PMSG 可增加蘭嶼豬的超級排卵數。

9、學者 Ratchamak, R.研究添加不同絲膠蛋白的濃度於豬精液冷凍保存，可提高精子於冷凍保存中的抗氧化的效果。絲膠蛋白為蠶在生產蠶絲時所分泌的一種蛋白質，並經萃取的方式取得，其類似熱休克蛋白 70 的蛋白質，該學者能將它應用於豬精液冷凍保存中實在是不簡單，有效的保護精子於冷凍保存不被低溫所損傷的一種蛋白質。

10、現在的畜牧業的生產可給合生物技術與人工生殖平台，提升全世界畜牧生產量。現今人工生殖技術已實際應用於牛及豬之繁殖，其包

括人工授精（AI）、冷凍精液、選性精子篩選等。另，牛隻已廣泛利用胚胎移植及其相關技術，有效輔助生產優良牛隻，目前本所生理組已具備上述之牛與豬相關技術，顯示出本所於人工生殖技術與國際相關技術並駕齊驅，未來將積極與國外大學及研究單位互訪及技術交流，提升更有效率及新穎之生殖技術，作為產業後盾及科技技術。

11、本次會議各國學者針對提升保育豬育成率之研究分別如下，Hwange 等研究指出在日糧中添加 75 ppm 奈米鐵(nano-Fe) 有助於豬隻生長；另 You 等研究指出，日糧中添加 0.1 %谷氨酸鈉(monosodium glutamate, MSG) 可促進保育豬採食量。本所高雄種畜繁殖場張伸彰主任研究指出，保育豬飼糧中添加 0.5-2%桑黃發酵物，對保育豬生長無不良的影響，此發酵物具有抗氧化效果。

12、 在全球暖化氣候變遷的影響，尋求耐(抗)熱方法或品種選育為各國研發之方向，本所高雄種畜繁殖場李秀蘭助理研究員與屏東科技大學沈朋志及張秀鑾教授共同研究，利用不同母系來源雜交豬種其母性遺傳對熱耐受性，目前研究成果顯示，KD 豬隻（母性遺傳源自梅山豬）於熱季飼料轉換率顯著較 DK 豬隻佳（母性遺傳源自杜洛克），KD 豬隻之呼吸頻率顯著較 DK 者少。Laodim 等研究是利用單苷酸多態性（SNPs）與產乳量性狀之相關分析，藉由相關性選留適合泰國環境下具耐高溫且高產牛隻。中興大學黃三元老師實驗室，從

Genome-wide association studies (GWAS)挑選 Body temperature (BT)基因利用單苷酸多態性（SNPs）進行分析，結果顯示，此方法可以作為雞隻耐熱型篩選方法。

13、 當地畜禽業者與本所黃振芳所長、陳立人組長、張伸彰主任、陳水財副研究員、屏東科技大學張秀鑾教授及林美貞副教授等專家學者（圖 17），針對馬國牛隻選育、台灣乳牛性能、進口乳牛及馬來西亞畜牧產業發展交互意見。

14、 Dr. Kazuhiro Kikuch 邀請本所黃振芳所長參加 2019 年在日本沖繩舉辦之黑豬產業學術交流研討會（圖 18）。

二、 建議

（一）由於大會演講及壁報涵蓋議題廣泛，在有限的時間內僅能就各重點議題節錄相關資訊。除研討會之主題演講與壁報展示外，大會也安排了一些贊助廠商展示最新的研發成果及儀器設備等，下次會議可藉由攤位展示我國產官學研發成果。

（二）藉此機會瞭解各國研究議題方向，同時也比對相關領域之研究設備，積極認識各國研究團隊，藉此鞏固本所與各國技術交流，同時並拓展未來更多國際合作之機會及推動。藉由此次研討會交流及精進科技研發，達成與國際接軌及推動我國新南向政策。

（三）參加國際會議之研究人員了解國際當前之研究方向及研究結果，作為自身研究方向之參考，參加國際會議亦可認識他國研究學者，。參加 AAAP會議能了解亞澳地區畜牧業之發展及國際畜產動向，亦建議相關單位應多提供經費補助研究同仁出國發表之經費，提升國內畜產之研究水準。

（四）2020年第19屆AAAP已決定在菲律賓之宿霧城舉辦，期待下次有更新穎的技術發表及交流，研發對國內畜牧產業更多的技術，提升研究人員研究成果及產業利機。

肆、口頭報告簡報

Moving Towards Agricultural 4.0 in Taiwan with Smart Technology of Top Five Robotic Applications in Dairy Cattle Farm

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Cow4.0

Robotic Systems for Dairy Cattle Farm

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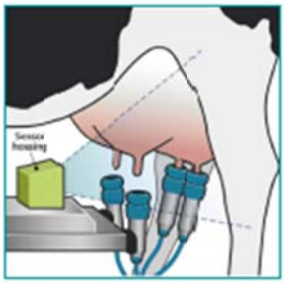
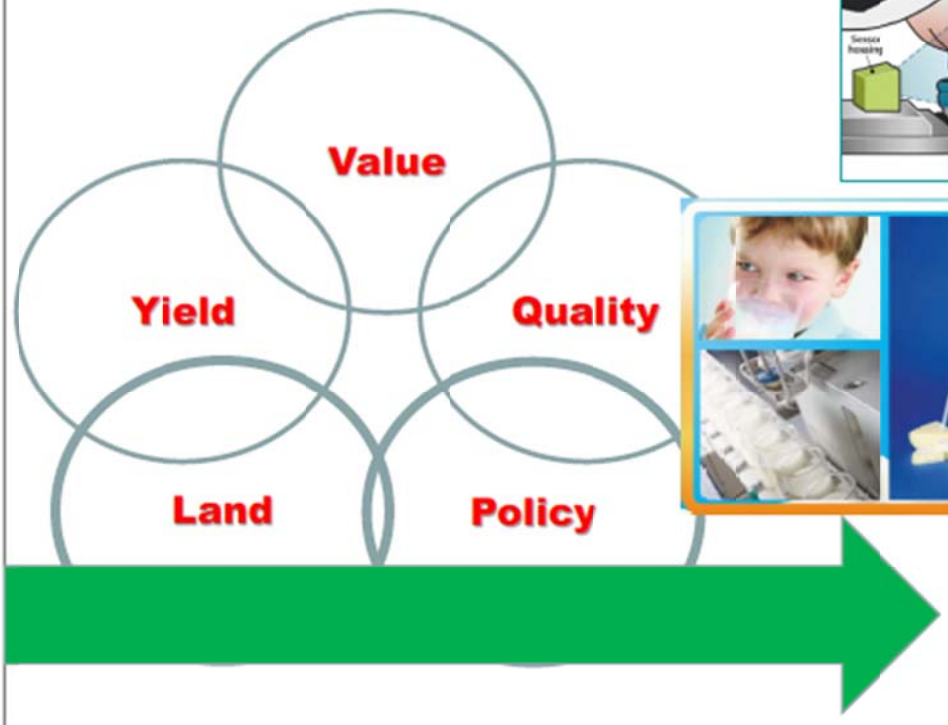
Key Factors in Dairy Industry





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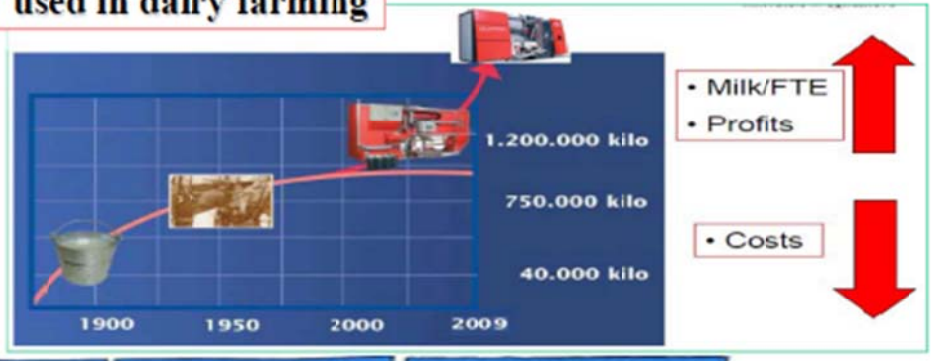
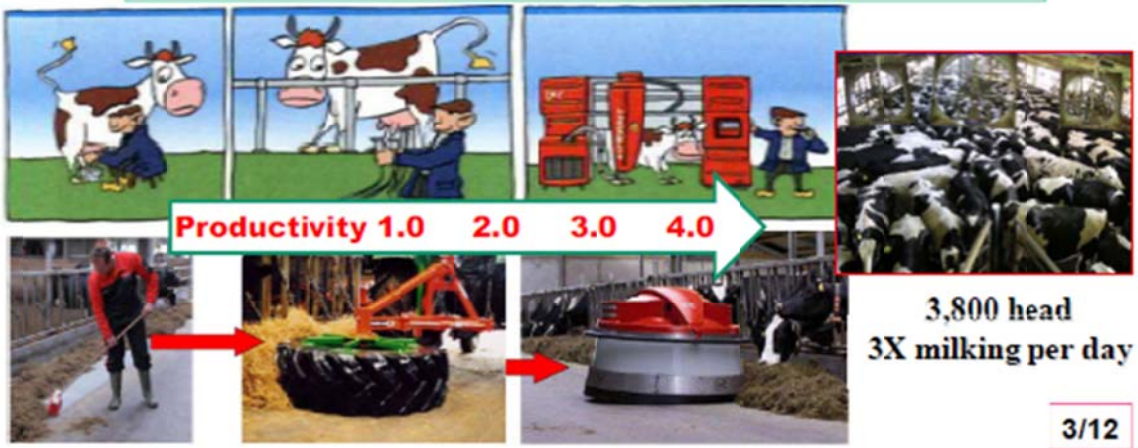
ICT used in dairy farming





3,800 head
3X milking per day

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International Non-Governmental Organization (1951 Rome Italy)

Members of ICAR (International Committee for Animal Recording)

2011 (in blue)

Japan
Korea
Taiwan

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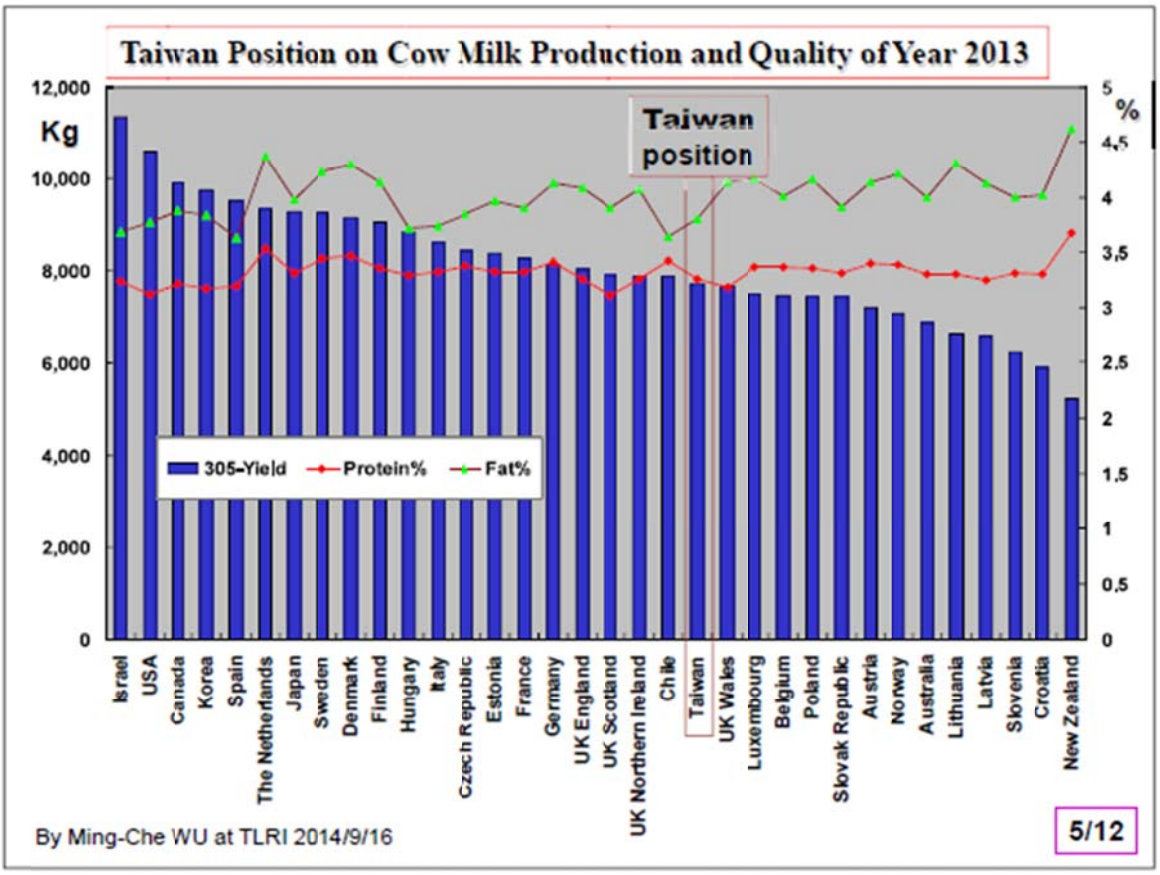
Taiwan Position on Cow Milk Production and Quality of Year 2013
Kg
%
Taiwan position
305-Yield
Protein%
Fat%
Israel
USA
Canada
Korea
Spain
The Netherlands
Japan
Sweden
Denmark
Finland
Hungary
Italy
Czech Republic
Estonia
France
Germany
UK England
UK Scotland
UK Northern Ireland
Chile
Taiwan
UK Wales
Luxembourg
Belgium
Poland
Slovak Republic
Austria
Norway
Australia
Lithuania
Latvia
Slovenia
Croatia
New Zealand
By Ming-Che WU at TLRI 2014/9/16
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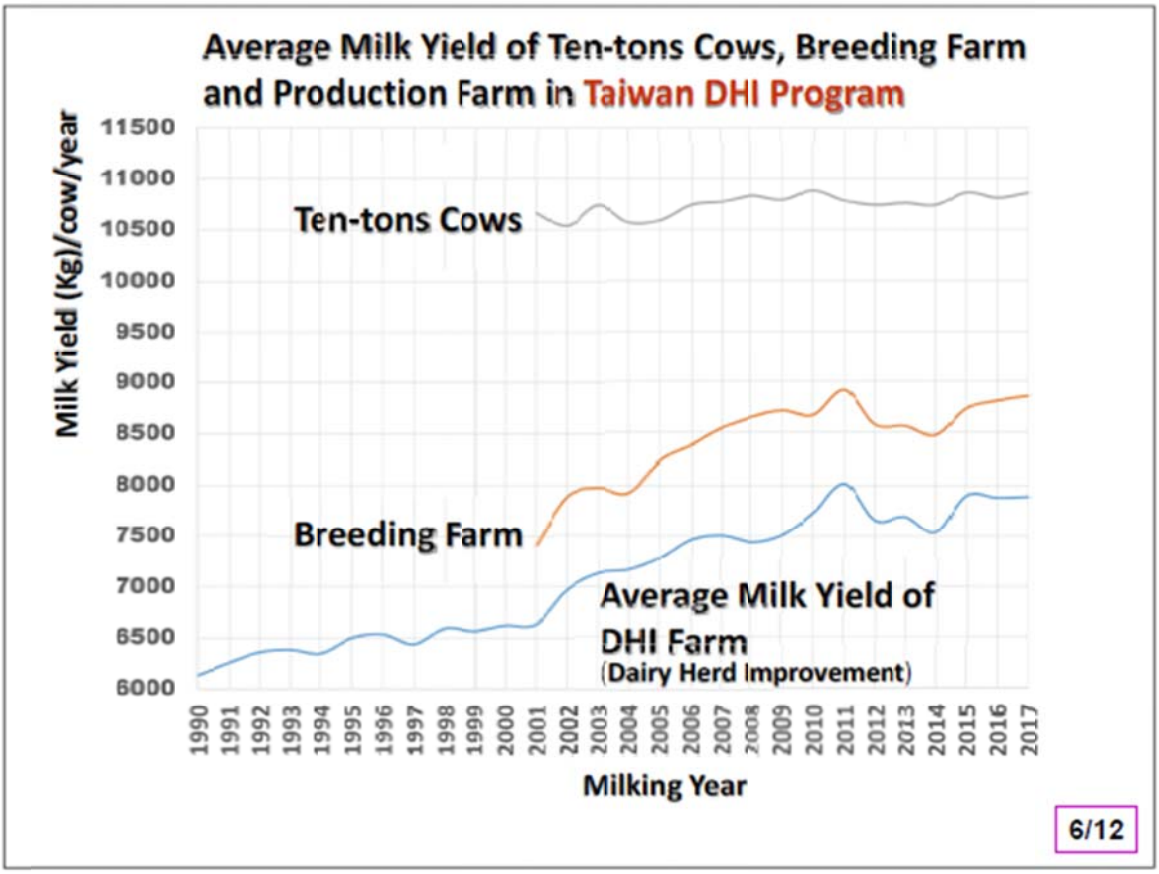

Average Milk Yield of Ten-tons Cows, Breeding Farm and Production Farm in Taiwan DHI Program
Milk Yield (Kg)/cow/year
Ten-tons Cows
Breeding Farm
Average Milk Yield of DHI Farm
(Dairy Herd Improvement)
Milking Year
6/12

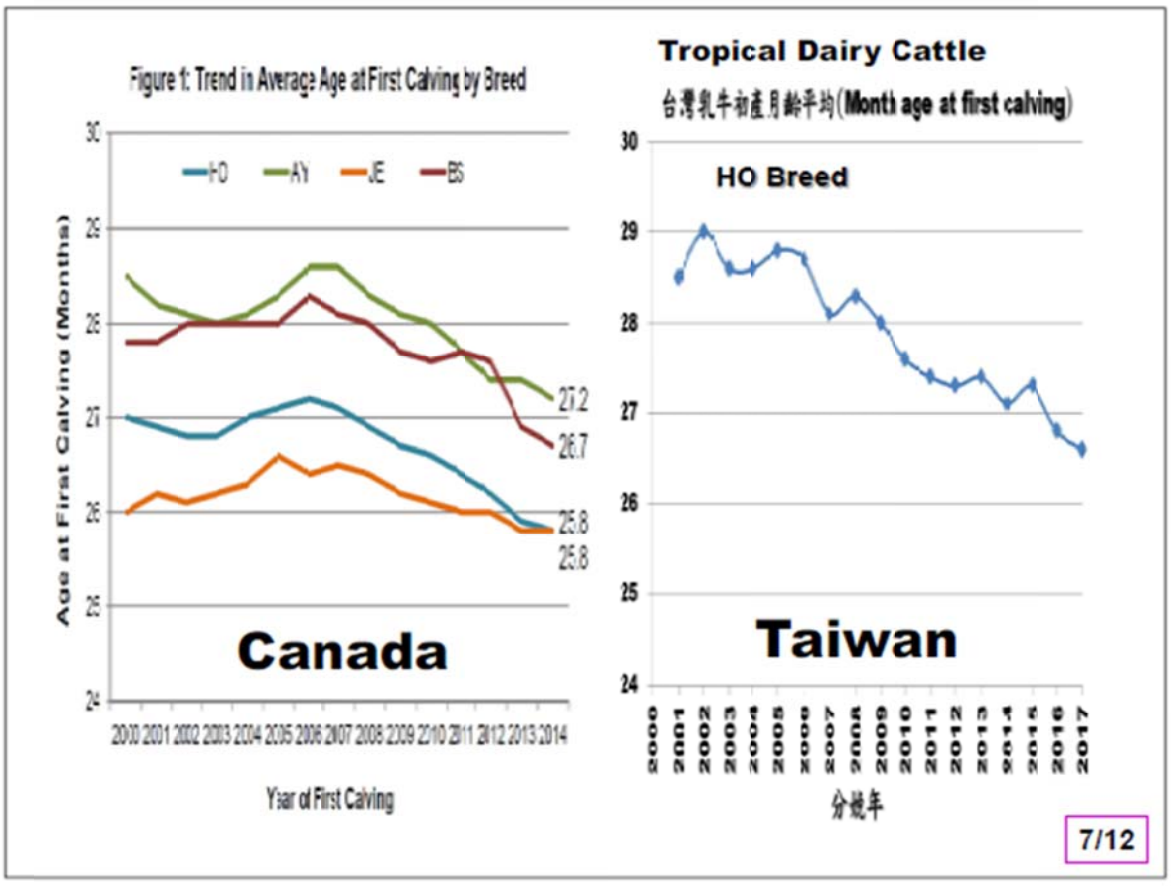
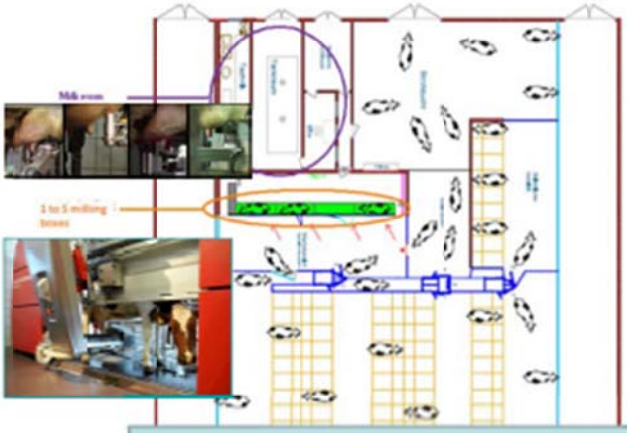


Figure 1: Trend in Average Age at First Calving by Breed
HO
AY
JE
BS
Age at First Calving (Months)
27.2
26.7
25.8
25.8
Canada
Year of First Calving
Tropical Dairy Cattle
台灣乳牛初產月齡平均(Month age at first calving)
HO Breed
Taiwan
分娩年
7/12


FUTURE FARMING
Robotic Milking
Jan Hulsen
Jack Rodenburg
Daily Activity
of a milking cow
1%
25%
45%
16%
13%
8/12

Smart Technology of Top Five Robotic Applications in Dairy Cattle Farm

Basic Milking Center Layout



Five working lines with robots in the dairy farm were designed to do smart farming as follows:

1. daily **milking** line,
2. daily **feeding** line for milking cows,
3. daily **clean up** the cow excrement and environmental clean line,
4. cycle management of **cow calving** and young **calf feeding** line, and
5. cycle monitoring of **cattle health** line for cows and heifers.

Smart Agriculture 4.0 Program for sustainable dairy farm

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推草料餵牛機器人代替飼養工

- **Smart technology of top five robotic applications was for enhancement of competitiveness, sustainable development, self-sufficiency rate, and market share of dairy farms in Taiwan.**
- **Operations of intelligent milking and/or feeding robots were introduced into 20 of cow breeding farms.**
- **Automatic feeding robots were used effectively to maintain the performance of milking cows with the improvement of milk quality and the dairy industry capacity. farming.**

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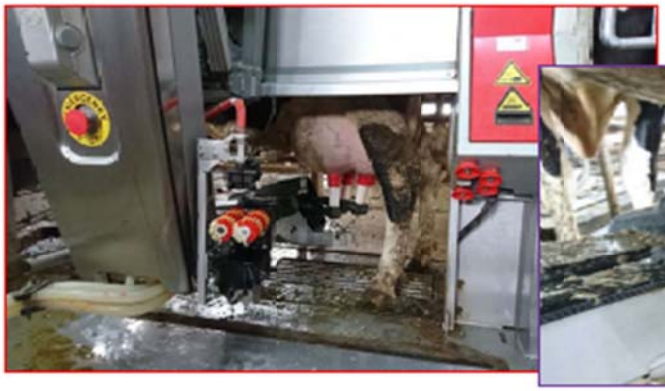
- **Automatic milking and calf feeding robots were used.**
- **Intelligent robots could be used to increase precision farming with replacement of aged-labors on the five daily work lines of dairy farming.**



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Dairy Industry – Milking Robots for Life Quality of Farmers

As Is

- Lack of workers to milk and feed cows
- Less use of precision farming technology in farms
- No proactive herd system for cow disease caring

To Be

- Have robotic systems in cow milking and feeding
- Have smart automatic herd management system
- Have better production efficiency and low cost

TAIWAN Touch Your Heart

As Is	Need Milking labors	To Be	Smart Milking Robots

Need labors to attach the milking cups to cow twice per day

Robotic milking system with milk quality sensors to replace labors. More milk production with no variation from labors in a quiet working environment.

No sensors to record data from individual cow in 70% of herds with paper recording

Robotic milking system or with rotary for relevant dairy farmers in five modes of major daily work lines, including daily milking, daily feeding, periodic cow health monitoring, periodic cow delivery and calves rearing, and daily cleaning manure environment.

Key Tech Need	Robots	Smart Farming	Big Data Analysis	Application Needs
	• Clean space and quiet milking environment • Smart milking and feeding robots	• Sensors for environment, body temperature and behavior • Robotic feeding system • Proactive herd management systems	• National milk yield data analysis • Herd profit analysis • Milking efficiency prediction	• Real-time sensors for cow health and milk quality • Pipeline grading of raw milk to create values for farmer incomes and farming life quality.

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伍、發表摘要

Proc. 18th AAAP Congress 2018, 1-5 Aug. 2018, Kuching, Malaysia

Evaluation of Boar Semen Quality by WST-8 Assay

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Enzyme-based WST-8 assay is well approved and widely applied to assess the viability in different types of cells. However, to our knowledge there is still no practical application of this technique for boar semen quality assessment. Therefore, the purpose of this study was to compare the results between WST-8 assay, flow cytometry (FC) and computer-assisted sperm analysis (CASA), in order to establish the protocol of WST-8 assay on boar semen. Two Duroc-Meishan crossbred boars of 18-26 months of age were used in this study. Boar semen was collected weekly and divided into live and killed portions. The live portion was kept at room temperature, and the killed portion was prepared by plunging into liquid nitrogen and thawed at 37°C for two cycles. The two portions of semen samples were diluted to 300 and 150 × 10^6 cells/ml with PBS, and then mixed to make semen aliquots of live and killed sperm ratios of 0/10, 2/8, 4/6, 6/4, 8/2, and 10/0 (v/v), respectively. Each sample was analyzed by (1) WST-8 assay at 0, 10, 20, 30, 40, 50, 60 min, (2) FC for sperm viability, acrosome integrity and mitochondria activity, and (3) CASA for motility. The results indicated that the most optimal boar semen concentration for WST-8 assay is 300 × 10^6 sperm/ml. The WST-8 reduction rates are highly correlated to sperm viability, acrosome integrity, mitochondria activity and motility, and the correlation coefficients increased with the prolonging of incubation time. According to our findings, WST-8 assay can be efficient and economical practice for the evaluation of boar semen quality.

Moving Towards Agricultural 4.0 in Taiwan with Smart Technology of Top Five Robotic Applications in Dairy Cattle Farm

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Smart Agriculture 4.0 Program of Taiwan targets three major fields, namely agriculture biotechnology, quality agriculture, and precision agriculture; precision agriculture is divided into two major categories: establishing foundations and promoting excellence. The current technical status of the aforementioned industries and post-promotion applications of the Smart Agriculture 4.0 Program for dairy farm are identified. The construction of production monitoring intelligent system and robotic milking operation parameterized wisdom network were carried out for the study of development and application of pilot robotics. Five working lines with robots in the dairy farm were designed to do smart farming as follows: (1) daily milking line, (2) daily feeding line for milking cows, (3) daily clean up the cow excrement and environmental clean line, (4) cycle management of cow calving and young calf feeding line, and (5) cycle monitoring of cattle health line for cows and heifers. This study with smart technology of top five robotic applications was for enhancement of competitiveness, sustainable development, self-sufficiency rate, and market share of dairy farms in Taiwan. Operations of intelligent milking and/or feeding robots were introduced into 20 of cow breeding farms. Automatic milking and feeding robots were used effectively to maintain the performance of milking cows with the improvement of milk quality and the dairy industry capacity. In summary, the enhancement of automatic operations in dairy cow herds in assistance of the artificial technical components and the intelligent robots could be used to increase precision farming with replacement of aged-labors on the five daily work lines of dairy farming.

Development of Forage Crop Management and Surveillance of Production Circumstance System on Dairy Industry with Mobile Devices in Taiwan

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Supply of good quality and healthy forages is indispensable for maintaining a healthy and sustainable dairy industry. Keeping growth circumstances clear and healthy is needed for producing healthy and safety forages. However, with many small-to-medium sized farms locating near forage production area in Taiwan, the production circumstances of forages are likely to be contaminated and the forges growth and quality will be influenced. Moreover, forage crops are sensitive to soil conditions and show quick response to fertilizer. Therefore, a tracking on soil and surroundings of forage growth area is good and necessary for the cultivation management. The system collected the basic information of soil image layers, and about 65,536 records of soil analysis data and soil fertility status from Taiwan Agriculture Research Institute (TARI) have been transferred into the database. Another 17,939 records of environmental information and image layers including underground water, waste management, air quality protection, environmental sanitation, surface water quality and incinerator locations were from the Environmental Protection Administration (EPA), Executive Yuan All fieldwork events were recorded in the mobile application software by mobile devices with Global Positioning System (GPS), Google Map, photography and 4G mobile internet. The fertilization, cultivation and harvest activities were recorded as picture and text data in this system. The photograph function was employed to assist the fieldwork and to record crop cultivation conditions. The developed system offers important picture and text recordings that serve as a reference to support meadow cultivation decision-making. In addition, various types of geographical and time information can be displayed through queries. In the fieldwork, the online map data and vector information are accessible in real time for browsing and geographic positioning. This program integrated the geographic space, photogrammetry, time, and attribute data of GIS for instant on-site recording of fieldwork.

Comparisons of Single and Double Layer Silica-Based Colloidal Medium on Rooster Sperm Separation

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Density gradient centrifugation has been extensively used as an effective method for sperm separation in farm animals during the past decades. It can eliminate debris and abnormal sperm from ejaculated semen to improve the efficiency of fertilization. However, only a few studies have attempted this technology in rooster semen so far. Therefore, the purpose of this study was to evaluate the effects of single and double layer silica-based colloidal media on rooster sperm, in order to obtain a practicable sperm purification protocol for the rooster. Forty (40) adult Taiwan Native chickens, L7, L9, L11 and L12 roosters were used in this study. Semen was routinely collected once a week and diluted 1:3 with PBS immediately after. The isotonic Percoll® (GE Healthcare, Uppsala, Sweden) was mixed with 1 × PBS to prepare 35% (P35), 40% (P40), 45% (P45), 70% (P70), 80% (P80) and 90% (P90) Percoll® solutions, respectively. Then the single layer (P70, P80 and P90) and double layer (P35/70, P40/80 and P45/90) density gradient media were prepared in 15 ml conical plastic centrifuge tubes. Thereafter, 1 ml of diluted semen was gently placed on top of the solutions and centrifuged at 800 × g for 20 minutes. After centrifugation, the sperm pellet was washed with PBS and resuspended in Poultry media (IMV, L'Aigle, France). Sperm motility was analyzed by CASA (Ceros II, IMV, L'Aigle, France). The percentage of motile/progressive sperm was significantly enhanced after single layer P70, P80 and P90 centrifugation by 14.6%/15.8%, 18.4%/27.1%, and 19.0%/27.5%, respectively ($p<0.05$). The similar results were also found in double layer P35/70, P40/80 and P45/90 centrifugation with 13.2%/16.4%, 10.8%/21.0%, and 14.1%/20.9% increments, respectively ($p<0.05$). Moreover, there was no significant difference on separation efficiency between single and double layer centrifugation. Our results initially indicated that either single layer or double layer silica-based colloidal medium centrifugation could be a feasible procedure for rooster sperm separation. Additionally, single layer centrifugation is more feasible and economical than the double layer. The effects of these procedures on the fertilizing capacity of rooster sperm will need to be further determined.

Utilization, Agronomic Traits and Nutritional Quality of Napier grass Varieties (*Pennisetum purpureum*) in Taiwan

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Napier grass (*Pennisetum spp.*) is one of the important perennial forage crops in Taiwan, and seven Napier grass varieties has been selected and named. Among them, Taishiu no.2 (TS 2) is particularly a more popular variety, which is higher productivity and more utility. Seven varieties of napier grass were grown in the field with a randomized complete block design for data collection. The results showed the varieties could be grouped by the coefficient of variation of the agronomic traits ranged from 6.5~58.2%. The coefficient of variation of node length (NL) with 58.2% was the highest, followed by the fresh weight per tiller (FWT) which was 51.1%, and that of leaf thickness (LT) with 6.5% was the lowest among all materials. In terms of databases, seven varieties could be classified into green group (6) and dark-red group (1), or taller (>100cm) group (3) and dwarf (<70cm) group (4). Four dwarf varieties all had higher nutritional quality (CP>10%, ADP about 37%) as compared to taller varieties. According to the agronomic traits and nutritional quality, it is suggested that farmers might grow the perfect variety for the need of their livestock. The dwarf varieties of napier grass though could benefit to all livestock, extending the area should be necessary to produce satisfied amount of feed. On the other hand, the results that there were diverse sources in napier grass germplasms are useful for the breeders to choose the optimum parents for hybridization breeding.

Effects of Cutting Intervals and Cutting Heights on the Silage Quality of *Pennisetum purpureum* in Taiwan

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Forage quality is one of the fundamental components that drives ruminant production. Napiergrass (*Pennisetum purpureum*) found in the tropical and subtropical regions of the world is renowned for having a track record of vigorous growth, high nutritive contents and palatability. An experimental design of 3x2 factorial arrangement complete randomized design (CRD) with 3 replications was executed at the Livestock Research Institute, Council of Agriculture, Executive Yuan, Taiwan, R.O.C. The aim of the research was to ascertain the optimal nutritive content of post-ensiled silage and silage quality of the NP cv. TS3 Napiergrass new cultivar. Treatments applied were 30, 60 and 90 days cutting intervals, at cutting heights of 10 and 20 cm during the spring and autumn seasons. All trials were conducted from 2016 to 2017. The result showed that crude protein (CP) value in the post-ensiled silage material deteriorated as the cutting intervals were extended from 30, 60 and 90 days, respectively. There were losses in the neutral detergent fiber (NDF), hemicellous (Hc) and water soluble carbohydrate (WSC) contents, while for the minerals and acid detergent fiber (ADF) for the most part had gain in their contents during the ensilage process. There was no significant difference ($P>0.05$) in the pH value among the cutting intervals. The interval at 60 days carried the higher lactic acid content while the 30 days the lower and that was significant different ($P<0.05$). It was noted that between intervals there was no significant difference ($P>0.05$) in the Flieg's score, however, the interval at 60 days had the higher value and the 90 days the lower. The cutting interval at 60 days was considered the most ideal for optimum quality and yield in the NP cv. TS3, while that of the 30 and 90 days intervals were far superior in quality and yield respectively.

Effects of Hormone Treatment with PMSG and HCG on Ovulation of Lanyu Pigs

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The Lanyu pig is an indigenous miniature breed from Orchid Island, which is off the southeastern coast of Taiwan. It is developed and characterized for biomedical research applications due to its small body size. The purpose of this study was to optimize the superovulation treatment for Lanyu pigs. Twenty-two female Lanyu pigs of 6 months of age were used in this study. All animals were orally administered Regumate® 20 mg/day for 18 days to synchronize the time of ovulation. Thereafter, each 1500 or 1000 IU pregnant mare's serum gonadotropin (PMSG) was intramuscularly (IM) injected to sows of 55-65 kg (Group 1) or 42-55 kg (Group 2) within 24 hours, and a IM dosage of 500 IU human chorionic gonadotrophin (hCG) was given after another 78 hours to induce superovulation. Artificial insemination (AI) was performed in sows 24 and 32 hours post hCG injection. Embryos were flushed out from oviducts of sows 55 hours after hCG injection by surgical procedures. The results indicated that the numbers of oocytes collected from Group 1 and Group 2 sows were 10.8 and 10.2 with the numbers of pronuclear embryos of 6.2 and 5.8, respectively. It was concluded that there were no significant differences in the numbers of oocytes and pronuclear embryos from Group 1 and Group 2 sows. Administration of different doses of PMSG depended on the body weight of sows followed by hCG both could lead to superpvulation in the Lanyu pigs.

Effect of *Phellinus linteus* Meal on Growth Performance and Biochemical Parameter in Piglet

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[2]Department of Animal Science, National Chung Hsing University, Taichung 402, Taiwan;
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In recent years, the rapidly growing global population has considerably increased the demand for grain. As a result, the cost of raw materials has significantly increased for dietary grain. Finding alternative feeds has become an important task for the feed industry. The objective of this study was to determine the effect of *Phellinus linteus* (PL) meal on growth performance and biochemical parameter in piglets. Sixty four black piglets, aged 4 weeks, were randomly distributed among 32 pens, and fed a piglet diet *ad libitum* during the nursery period, with each pen containing 2 males or 2 females depending on a completely randomised design. Each treatment comprised of 8 pens (total of 16 geese, half male and female), and included: 1) control (corn-soybean meal), 2) supplemented with 0.5% of PL meal (0.5% PL), 3) supplemented with 1% of PL meal (1% PL), 4) supplemented with 2% of PL meal (2% PL) groups for 6 weeks, respectively. The results revealed no significant differences among the groups for body weight, gain body weight and feed conversion ratio. The immunoglobulin G content of the serum in the control group was higher than that of the 0.5%PL and 1%PL groups at the week of 11. There were no significant differences among the groups for blood biochemical parameters in piglets at week 11. In conclusion, this study found that supplementation with PL meal in diet had no adverse effect on growth performance of piglets. However, PL meal groups in diet had lower immunoglobulin G level in piglets.

Acquisition of Intangible Assets and Role of Training Ranches for New-Entrant Dairy Farmers in Hokkaido

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In Japan, there is an urgent need for measures to counter the decline in the agricultural population as a result of ageing and a lack of successors. Although new-entrant dairy farmer is very popular in Hokkaido, there have been few reports in Prefecture (excluding of Hokkaido). Furthermore, few studies have investigated factors associated with the acquisition of intangible assets for new-entrant dairy farmers in Japan. Therefore, the aim of this study was to determine (1) how new-entrant dairy farmers can acquire intangible assets and (2) the role of training ranch in the acquisition of intangible assets. We conducted a questionnaire survey of 37 new-entrant dairy farmers in Hokkaido and also interviewed four of the respondents. The new-entrant dairy farmers considered the following intangible assets to be of high importance, regardless of whether or not they worked at a training ranch: (1) breeding technology, (2) feeding management technology and (3) relationships with the community. Form the questionnaire survey, can see that the intangible assets that the farmer feels important are similar. All of the farmers who were interviewed used the following support services: the administration's characteristic support and assistance, which includes a subsidy for half of the leasing fee and a subsidy equivalent to the property tax, and the business leasing system of Hokkaido Agricultural Corporation. From this interview, can see that the region and industry are closely related. These findings demonstrate that the acquisition of both tangible (i.e. farmland, facilities and cows) and intangible assets has a large effect on new-entrant dairy farmers in the training ranch and that the administration's own measures and agricultural cooperatives contribute to the smooth transition to dairy farming and management stability.

陸、照片附錄

圖 1.大會會場

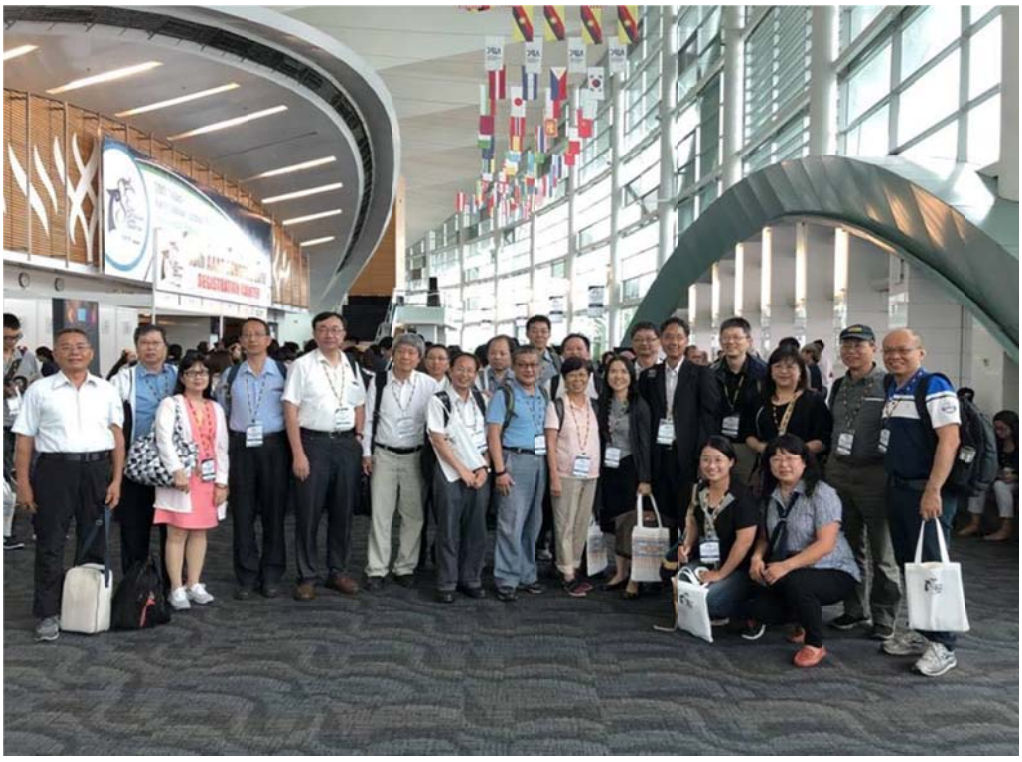

圖 2.台灣研究學者專家團體合照

圖 3.大會主席致詞

圖 4.專題演講

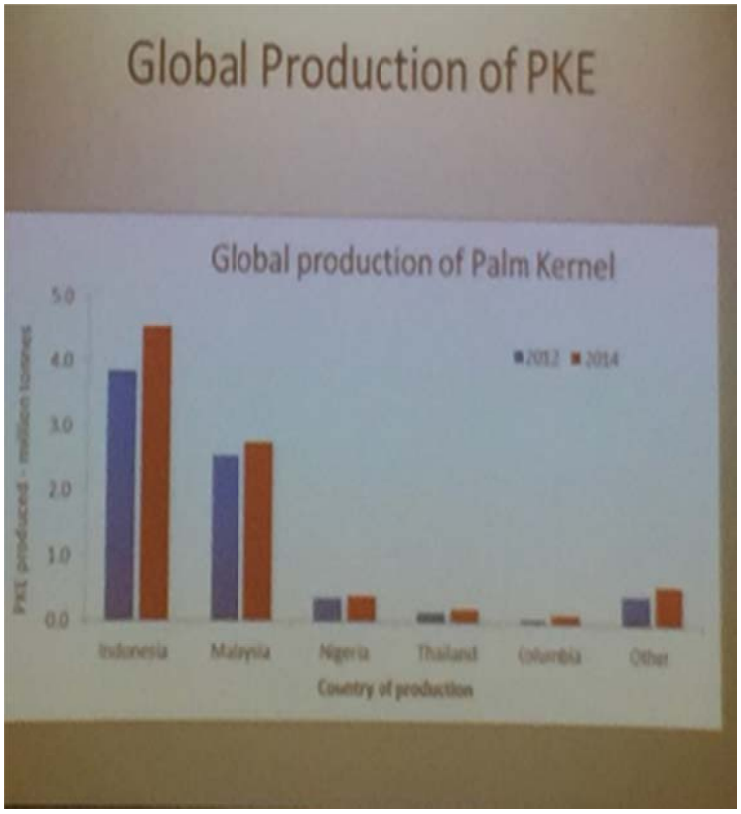

圖 5.全球各國棕櫚粕生產量

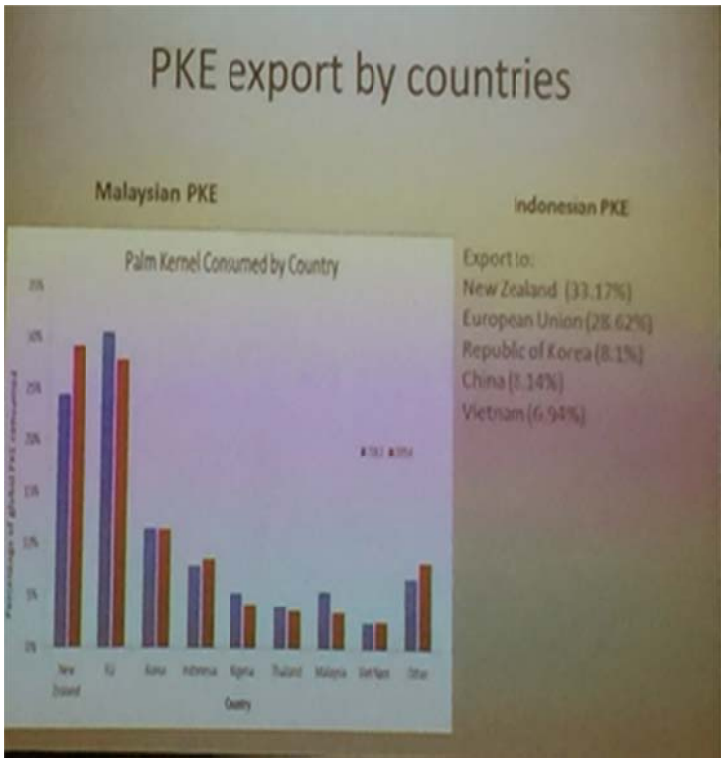

圖 6.印尼及馬來西亞之棕櫚粕出口各國比例

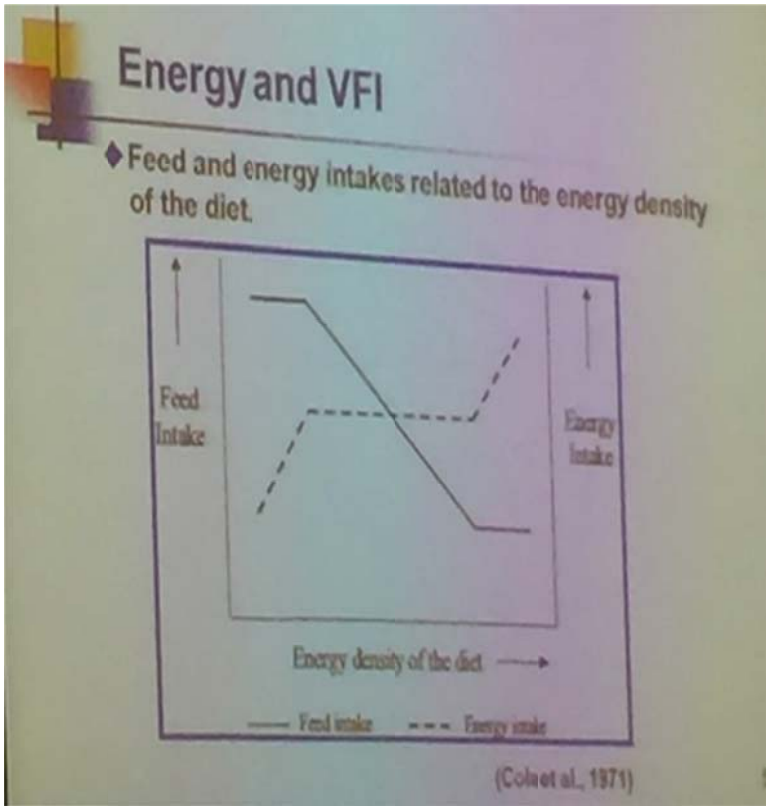

圖 7. 飼糧能量與採食量關係

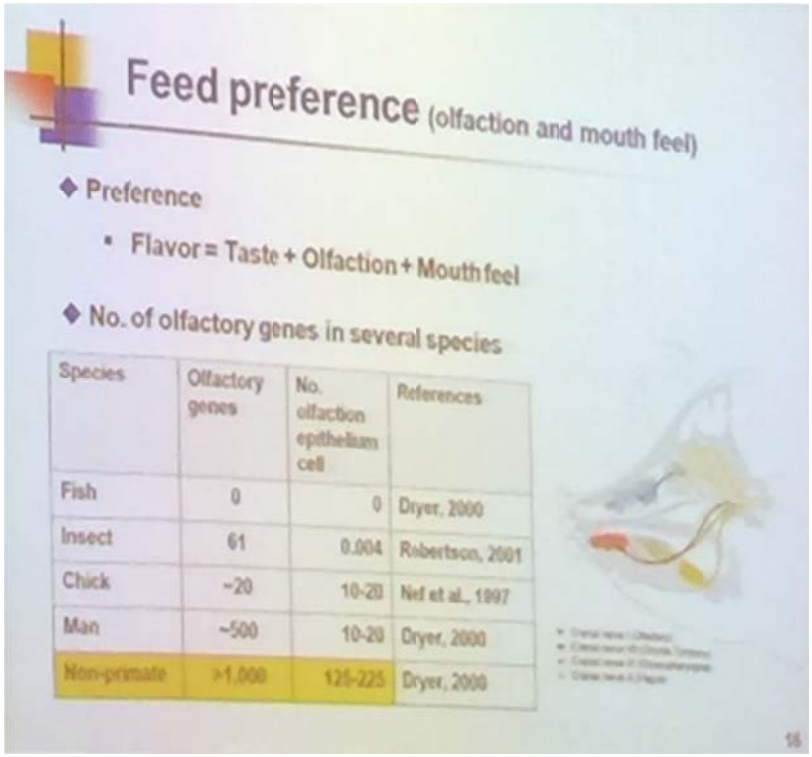

圖 8. 飼糧風味評估方式及嗅覺基因

圖 9.口頭發表-林秀蓮理研究員

圖 10. 口頭發表-吳明哲組長

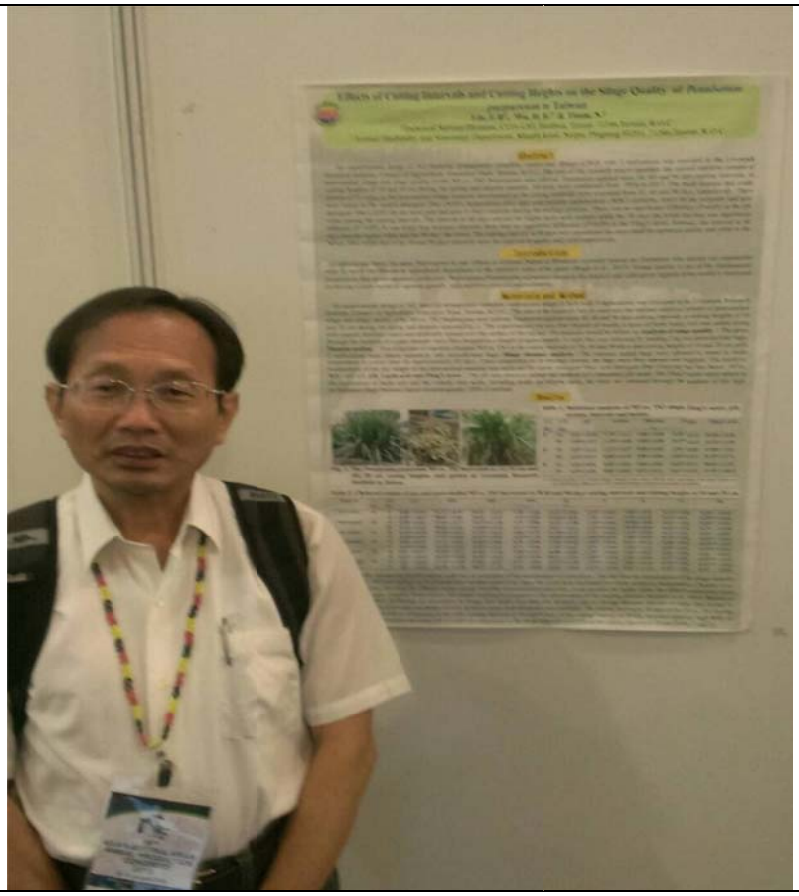

圖 11.海報論文發表-林正斌研究員兼組長

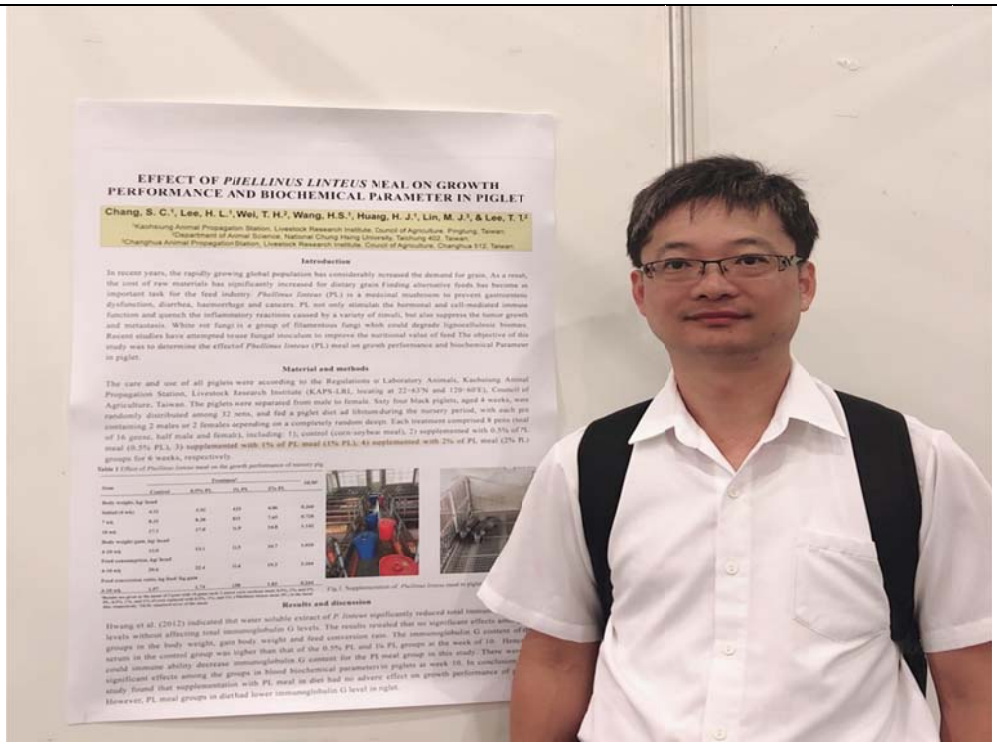

圖 12. 海報論文發表-張伸彰副研究員兼主任

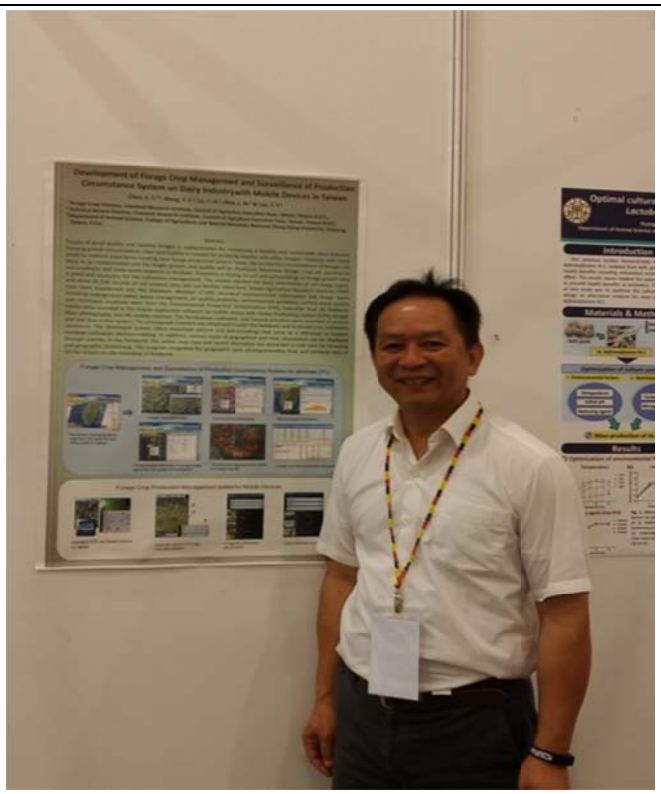

圖 13. 海報論文發表-陳水財副研究員

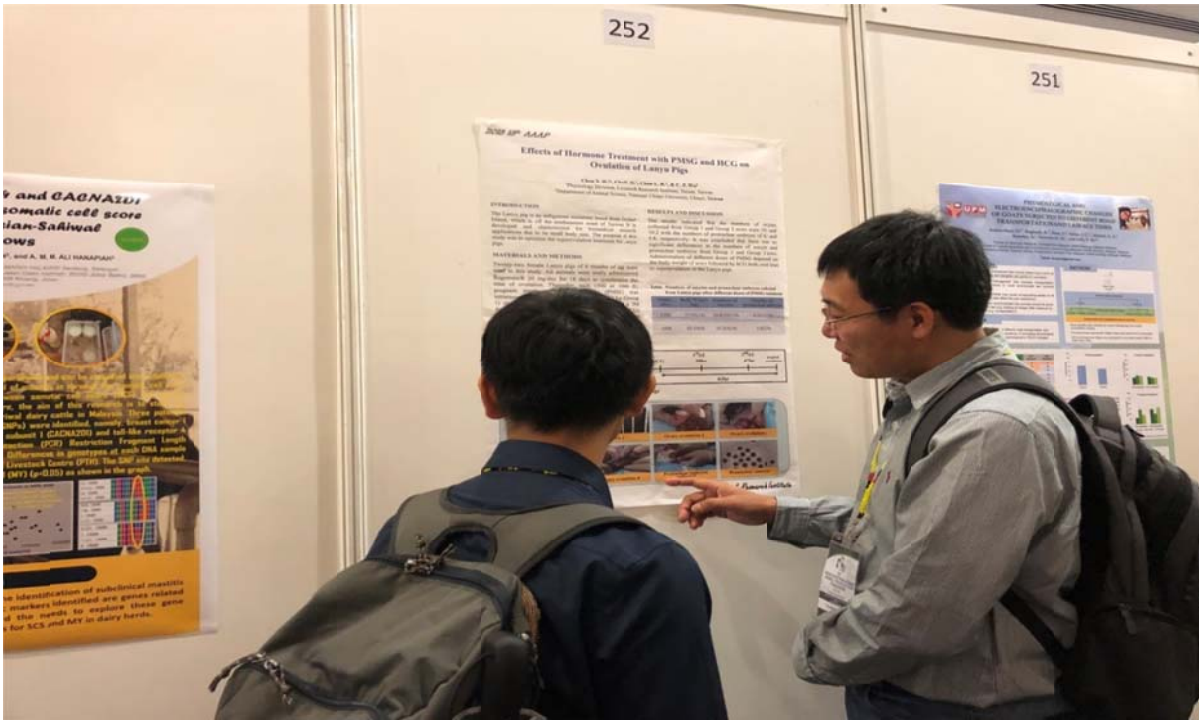

圖 14.海報論文發表-陳裕信助理研究員

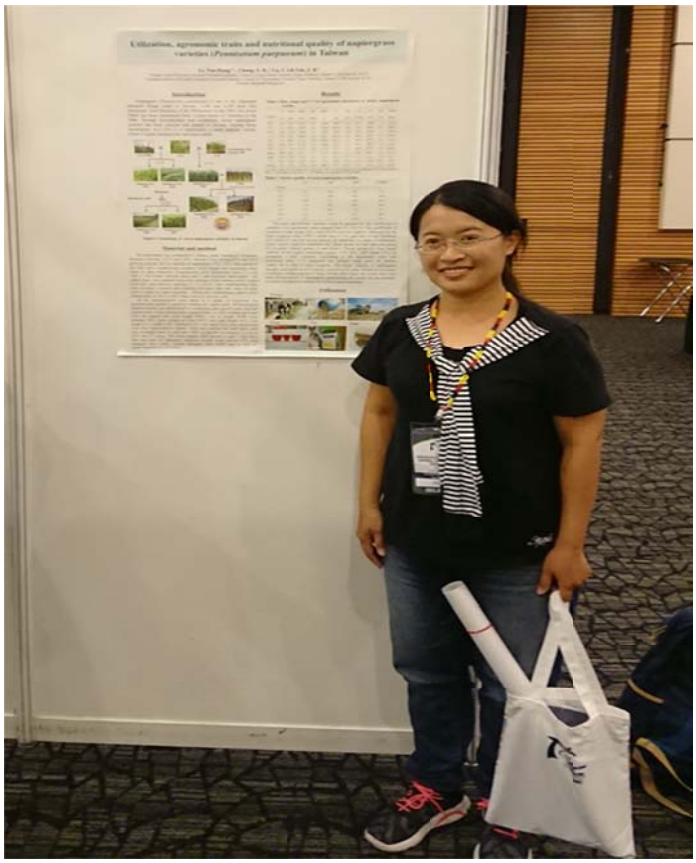

圖 15. 海報論文發表-李姿蓉助理研究員

圖 16. 海報論文發表-李秀蘭助理研究員

圖 17.當地畜禽業者與畜試所黃振芳所長、陳立人組長、張伸彰主任、陳水財副研究員及屏東科技大學張秀鑾教授、林美貞副教授交流

圖 18.黃振芳所長與 Dr. Kazuhiro Kikuchi （黑豬產業學術交流）