

Pig Semen Production and Collection



種豬育種策略 Pig Breeding

種用登錄 Genetic
全胎檢定 Reproduction
基因選種 Evaluation
市場拓展 Auction
創新加值 Taiwan-value

行政院農業委員會 畜產試驗所
行政院農業委員會 畜產試驗所
中央畜產會
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Amills, Marcel, Clop, Alex, Ramirez, Oscar, and Pérez-Enciso, Miguel (Sep 2010) **Origin and Genetic Diversity of Pig Breeds.**
In: eLS. John Wiley & Sons Ltd, Chichester. <http://www.els.net> [doi: 10.1002/9780470015902.a0022884]

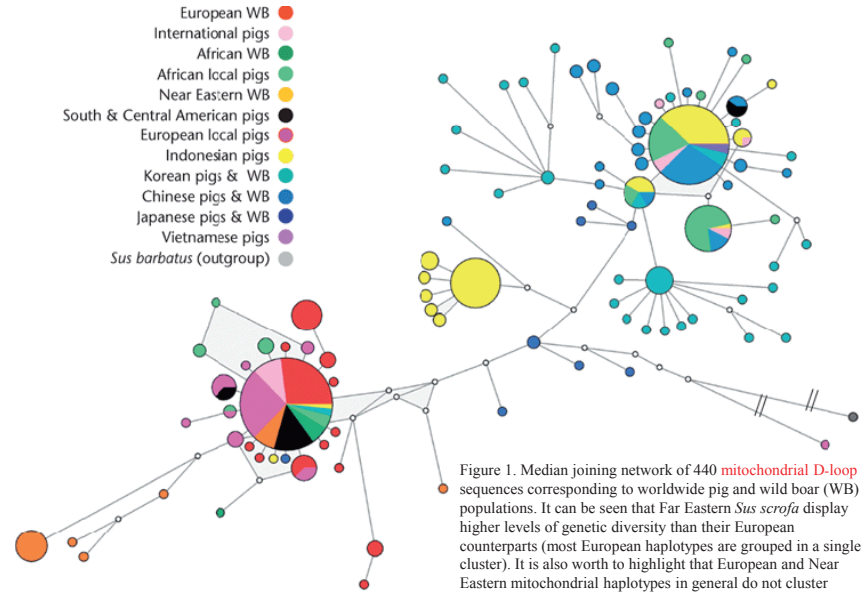


Figure 1. Median joining network of 440 mitochondrial D-loop sequences corresponding to worldwide pig and wild boar (WB) populations. It can be seen that Far Eastern *Sus scrofa* display higher levels of genetic diversity than their European counterparts (most European haplotypes are grouped in a single cluster). It is also worth to highlight that European and Near Eastern mitochondrial haplotypes in general do not cluster together suggesting that both populations have distinct origins.

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http://www.angrin.tlri.gov.tw/pig_all.htm

Pig Web

畜產種原資訊網 Animal Genetic Resources Information Network

種原資料庫 圖鑑分布 基因圖 刊物 保種場 DNA庫 種原普普 檢索 生物資訊

● 種原點檢率
● 熱門種豬
● 年報種豬
● 國際場名次
● 種豬檢定表
● 種畜登錄表
● 種畜字彙
● 基因標檢測進度
● 北歐會第一屆種豬
● 檢定地標科展種豬
● 進口冷血鹿仔紀錄
● 產精達萬倍公豬榜
● 特選種
● 種豬運出口統計

● 種豬拍賣影片影片檔 Photo and Movie
● 種豬最佳紀錄 Top Records
● 種育種豬紀錄項目 Pig Breeding Program (2005-2014)
● 更新前的網頁 Web page before 20120131
● 檢定公母豬類別 Performance Test Data

03575

QR Code: TWpig

● Breed
● Boar Semen Net
● Pedigree Reg. of D, L & Y
● Number of Teats
● Litter Size at Birth
● Award Movie
● Growth Performance Test/Class
● Body Weight at 70 Day Old
● Body Weight at 150 Day Old
● Growth Trait Data
● Selection Index since 1975
● Chr 6 Stress Gene Hal-1843
● Chr 1 Reproduction ESR
● Chr 16 Reproduction PRLR
● Chr XV Line Marker
● Chr 6 Meat Quality HFABP
● Chr 2 Meat Quality IGF2in3
● Chr 2 Meat Quality IGF2in7
● Pig Photo and Video
● Top Records

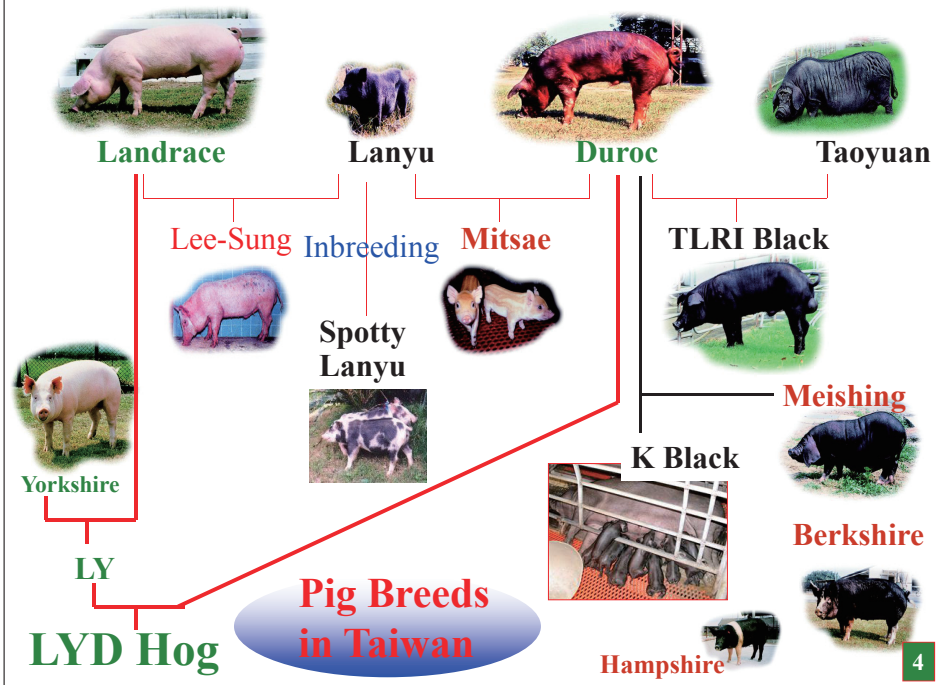
種豬產業發展里程

19 00 03 34 50 60 75 80 81 83 85 86 88 89 93 96 99 20 02 05 05 08 09 11 13

2014 種豬品質提升研

http://www.angrin.tlri.gov.tw/english/index_pig.htm

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POTENTIAL, OPPORTUNITIES & CHALLENGES



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Pig Breeding Database of Taiwan

www.angrin.tlri.gov.tw

AID-COA
TLRI
NAIF
FFASI
NPTU
ATIT

Goal:

Feed efficiency (Feed/Gain) of growing boars from 40 to 110 kg of body weight

FE=3.17 in 1975 and upgraded to FE=2.08 in 2005, projected to FE=1.80 in 2015

Major breed: Duroc

Hsinhua Station
D gilt, The Best



Fortune D0634-11
(FE=1.95) 2005/3/13

Hsinhua Station
D boar, The Best



Hwei Huang D0329-05
(FE=1.90) 2003/8/26

Zhunan Station
D boar, The Best



Shun An D0785-01
(FE=1.51) 2004/6/29

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Technology Chain for Breeding Pig Industry

Birth Recording	Trait Performance Test	Pedigree Registration	Auction
Mating date of female (NS/AI) Farrowing date of sows (F/AF) Birth pedigree: Sire Dam Sire of Sire Dam of Sire Sire of Dam Dam of Dam	Pigs born (male/female) Teat number (left/right) Birth weight 3-week body weight 5-month body weight Day of age at 110(100) kg BW (male/female) Back fat thickness at 110(100) kg BW (M/F) 40~110 (100) kg body weight (male/female) — Average daily gain Feed efficiency (FE) Body conformation evaluation Conformation trait (length, width, height, depth) Semen quality (Total sperm counts , normality) Day age to be sire or dam (Age at first litter)	Basic Pedigree Growth Performance (GP) Reproductive Performance (RP) Superb GP Superb RP Plum Blossom Award Genotype — Hal-1843(CRC) ESR HFABP IGF2in7 IGF2in3 PRLR XY-markers	Test Station (7.5 months old)— Duroc Landrace Yorkshire FFASI (8~10 months old)— Duroc Landrace Yorkshire Berkshire Black

Pedigree Registration: NAIF

Performance Test Station: Hsinhua (Farm should have at least 30 registered sows of one breed.)

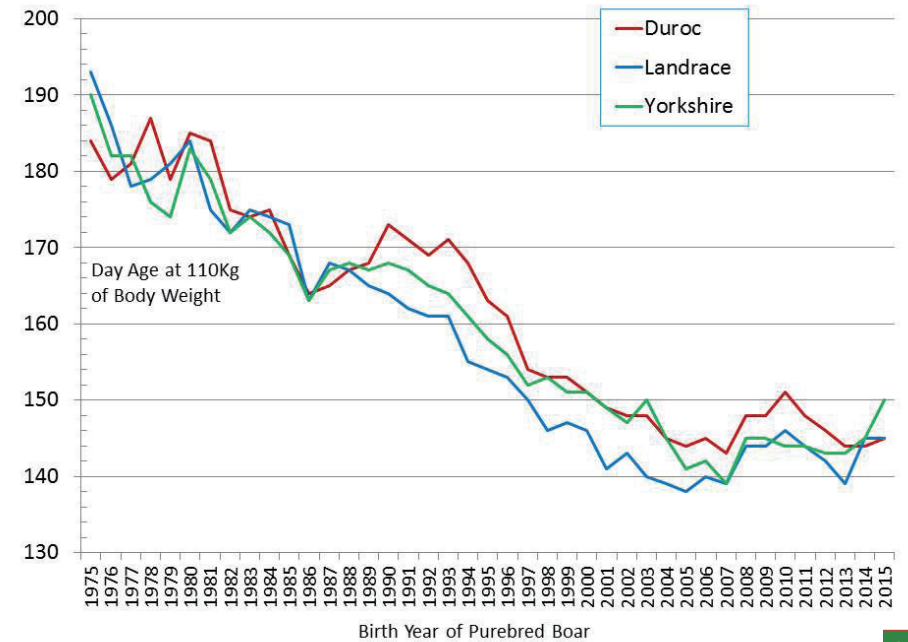
Genotyping: TLRI, NPTU (Prof. HL Chang), NAIF

Conformation Evaluation: YY Sung, LC Hsia, RC Weng, YY Lai, PH Wang

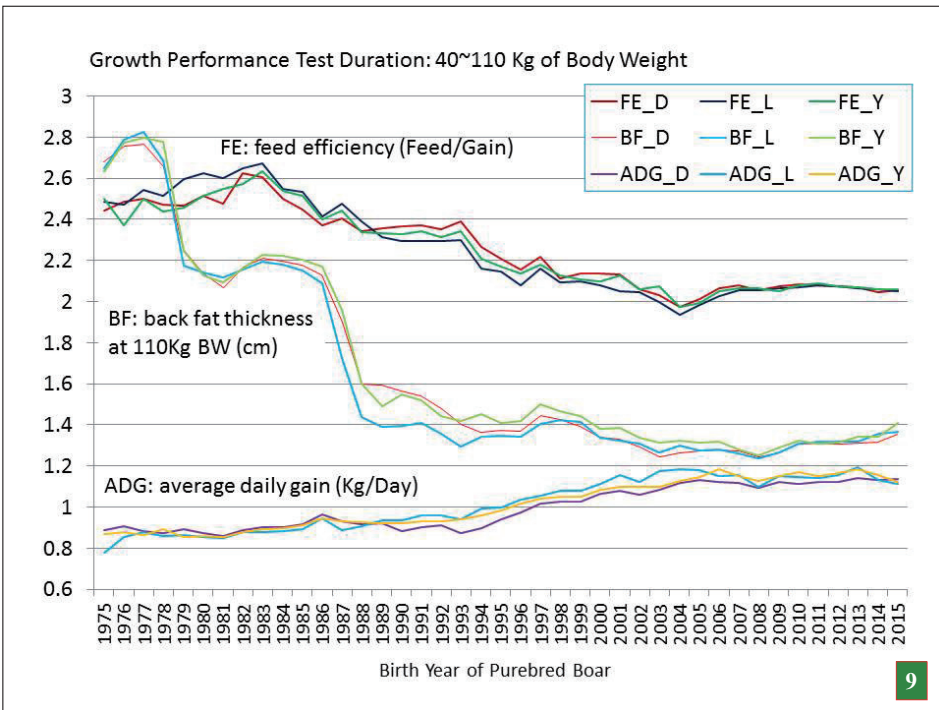
Hoof Evaluation: TLRI (NT Yen, KC Liu, KY Lin)

Selection Index: TLRI (MC Wu and YC Huang)

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Pork belly is popular in Asian cuisine!

頸椎 (1-7) 胸椎 (1-15) 腰椎 (1-6) 薦椎 (4段) 尾椎 後腿

肩胛 胸骨 背脊 腹脇 小里肌

Belly

Belly

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Lean meat is gene expression!

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PSE Normal

Pork quality is gene expression

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	Color	Firmness/ Wetness	Marbling (IMF)	
PSE (Hal-1843 Test) AA AB BB				1 (HFABP genotyping)
RSE				2 LL0 LL1 LL2
RFN				3 HL3 HL4 HL5
DFD				4 HH6 5

Pork marbling is gene expression!

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Marker Genotype Screened by Pig Industry in Taiwan

Favorable genotype	Chr.	Start year
Hal-1843 AA	6	1996
ESR MM + MN	1	2001
HFABP HH6 + HL5	6	2002
IGF27 FF	2	2005
IGF23 QQ	2	2005
PRLR PP+LP	16	2008
XY-marker Sw1325	XY	2012

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Regulation for Genomic Breeding of Farm Animals in Taiwan

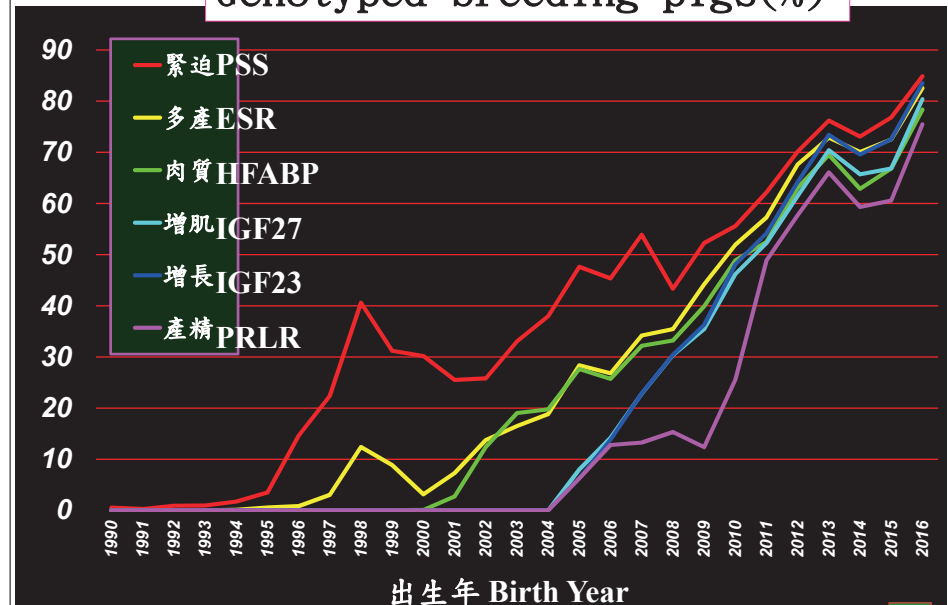
Animal Industry Act Article 17

The competent authority may dispatch inspector to examine or test **the breeding flock**, breeding stock, facilities, pedigree registry and related records of breeders, and the breeders shall not evade, interfere with or object to such examination or testing.

Breeding flock or breeding stock found to have contracted notified disease or have **hereditary disease** during the aforesaid examination or testing shall be **banned from breeding**. The aforesaid inspectors shall present their identification when carrying out their duty.

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Genotyped breeding pigs(%)



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- **Meat quality (intramuscular fat or marbling) of pork is related to meat eating quality.**
- **Fat marbling is designed as the percentage of intramuscular fat.**

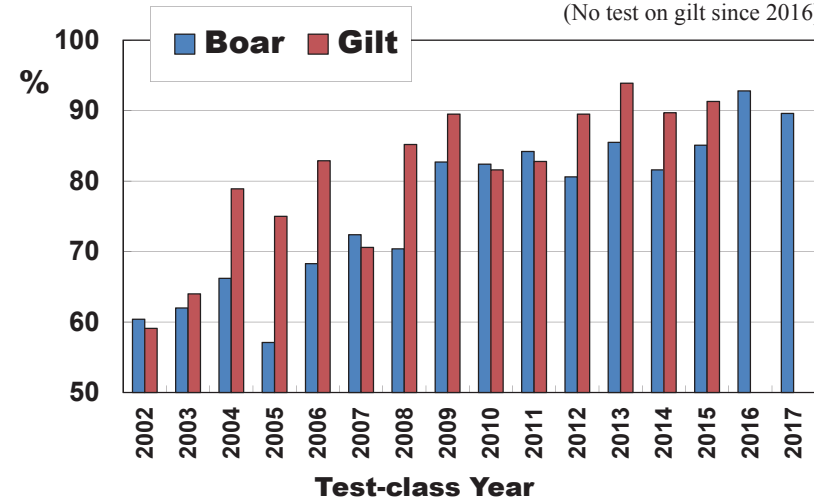
- **H, a and d allele from three loci of heart fatty acid-binding protein (HFABP) gene are favorable alleles to fat marbling.**
- **Marker group of LL, HL or HH is based upon favorable allele counts:**
 - 0~2 for lower quality (LL)**
 - 3~5 for average quality (HL)**
 - 6 for higher quality (HH)**

	aa	Aa	AA	
HH	HH6	HL5	HL4	dd
	HL5	HL4	HL3	Dd
	HL4	HL3	LL2	DD
Hh	HL5	HL4	HL3	dd
	HL4	HL3	LL2	Dd
	HL3	LL2	LL1	DD
hh	HL4	HL3	LL2	dd
	HL3	LL2	LL1	Dd
	LL2	LL1	LL0	DD

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HH6 Genotype frequency of HFABP gene in Duroc pigs at Hsinhua Station

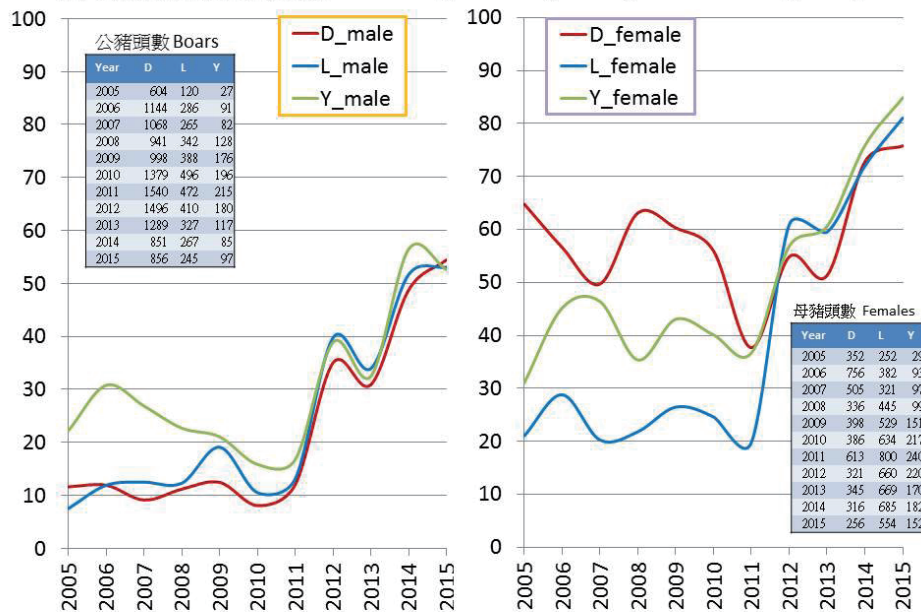
(No test on gilt since 2016)



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A-5

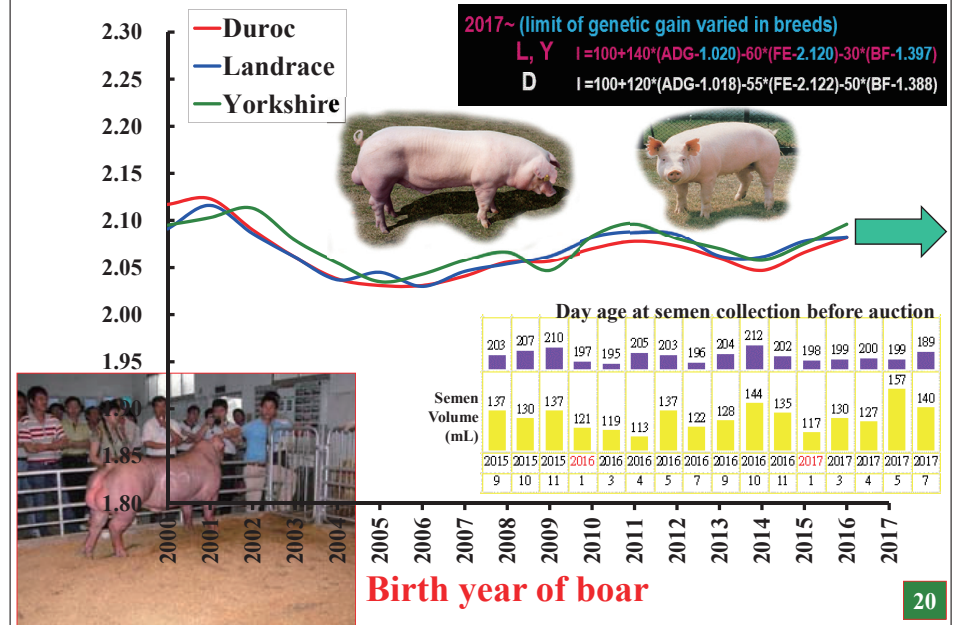
基因檢測後血統登錄完成率 Percentage of Pedigree Registration with genotypes



經由種豬協會送血樣檢測年 Year of blood samples received via FFSAI

19

Feed Efficiency (feed/gain) from 40 to 110 kg of body weight



Birth year of boar

20



最高價公豬

仙佳 D1759-01 200,000元
名次/指數: 1 體型: 腳蹄:

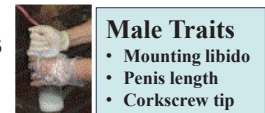
福昌 L0770-01 191,000元
名次/指數: 2 體型: 1 腳蹄: 2

Age: 218 days old

仙佳 Y0019-03 220,000元
名次/指數: 1 體型: 腳蹄:



Total sperm count per collection in boars within 300 days of age



TSC (Billion) (10E9)	Breed (Collection Date: 2011/1/3-2015/12/9)(N=1566)				TSC (Billion) (10E9)	Breed (Collection Date: 2016/1/4-2017/6/3)(N=406)			
	Head	Duroc	Landrace	Yorkshire Black		Head	Duroc	Landrace	Yorkshire Black
230-239	1		1		230-239				
160-169	1		1		160-169				
150-159	3/2		1		150-159				
140-149	4/2		2		140-149				
130-139	3/1		2		130-139	1/1			
120-129	12/9		3		120-129	7/5		2	
110-119	35/24		8	3	110-119	18/17		1	
100-109	52/38		11	2	100-109	37/26		10	1
90-99	116/86		21	5	90-99	56/44		12	
80-89	210/140		47	17	80-89	82/65		17	
70-79	283/207		53	15	70-79	80/55		20	1
60-69	330/231		64	27	60-69	63/48		10	3
50-59	260/192		46	10	50-59	42/34		6	2
40-49	144/95		31	13	40-49	17/14		2	1
30-39	87/66		10	6	30-39	1/1			
20-29	20/13		2	3	20-29	1/1			
10-19	5/4		1		10-19	1/1			

Elite Boar



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Boar Trait Sheet

Sperm Quality Sheet of Boar at 9 Month Old (Query Date: 2015/1/7)

Breed Ear No	Birth Date	Breeding Pig Farm
D0745-02	2014/2/7	Shui Po

PSS Genotype	ESR Genotype	Meat Quality Genotype	IGF27-FG Genotype
AA	NN	HH6(HHead)	FF

Collection Date	Collection Age, Days
2014/1/5	271

Mounting Desire	Penis Appearance	Penis Length(cm)	Hind Leg Strength
High	正紫	25	Normal

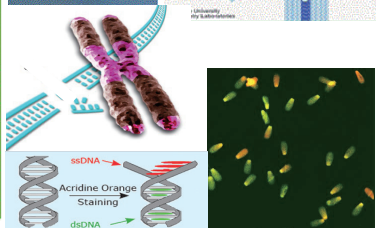
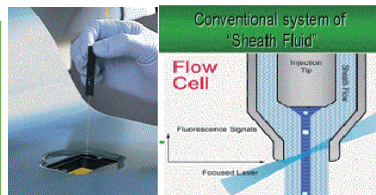
Semen Volume (mL)	Semen Color	Sperm Activity (50+ Active)	Sperm Conc. Level (+++ Thicknes)
150	Milk White	90+++	+++

V75G	A40G	M30B	C500B	CH90B	SC35G	OX90B	EO
(+74)	(+39)	(+31)	(+501)	(+91)	(+94)	(+91)	(+1)
91	52	18	351	69	98	2	0.42

Sperm Quality Assay:

- Measuring key physiological functions for insights in the fertilisation potential of semen and/or its genitor
1. **V75G Viability** - Indicator of the sperm membrane integrity as percentage of viable spermatozoa
 2. **A40G Viability & Acrosome integrity** - Indicator of the acrosome integrity and it is essential for fertilization
 3. **M30B MitopotentiaL** - Indicator of the mitochondrial status to show the integrity of the mitochondria
 - 4&5. **C500B & CH90B Calcium level** - Indicator of the level of Ca in the sperm head - One of the signs of capacitation of sperm
 6. **SC35G DNA fragmentation & DNA TUNEL assay** - Indicator of the condensation of the DNA structure
 7. **OX90B Oxidation level** - Indicator of intracellular level of reactive oxygen species needed for sperm function but that are harmful at a high level
 8. **EO Bacterial count** - Total bacterial count

Sperm Quality Assay



種豬產業協會 (拍賣日: 2017/6/6) 指數第一種豬拍賣影片 (紫色為 確能親來源場不同)

性品種 (公/母)	名次	種豬場	父(雄豬)		母(雌豬)		出生日期	拍賣日期	乳頭數	繁殖力	基因型	產豬性狀																
			耳號	登錄號	耳號	登錄號																						
公	D	1	2	福昌	1302-01	鈞鈞	0193-05	21925	26301	730	泰安	1209-11	213467	26801	1285	2016/08/17	297	67	A A	NN	HH6	FG	QQ	LL	228	918	25	
公	D	1	3	1	福昌	1309-04	一軒	1144-04	216847	26301	132	瑞珠	1519-12	216072	26801	1080	2016/08/17	294	88	A A	NN	HH6	FG	QQ	LL	205	899	25
公	L	1	1	1	福昌	1037-05	元龍	0449-04	21432	26301	454	洋潔	0362-13	222945	26801	323	2016/08/29	282	88	A A	MN	LL0	FF	QQ	LL	210	638	25
母	L	1	1	1	福昌	1001-11	元禧	1711-06	21430	26301	1242	慧明	1745-12	217221	26801	1203	2016/10/23	227	00	A A	NN	LL2	FF	QQ	LL	-	-	-
母	Y	1	1	1	福昌	1270-12	杜成	1121-04	21945	26301	661	洋琪	1584-13	220185	26801	518	2016/09/30	250	77	A A	MM	HL4	FF	QQ	LL	-	-	-
母	L	1	1	1	金龍	0640-02	名門	1384-09	211342	26001	1449	生全	1484-07	223086	64501	290	2016/07/08	334	77	A A	NN	HL4	FF	QQ	LL	-	-	-

福昌 D130201公 父1209-11 生日: 2016/8/14 基因密碼: AA-NN-HH6-FG-QQ-LP 標購者: 黃清富 成交價: 62,000元	福昌 D1309-04公 父1144-04 母1519-12 生日: 2016/8/17 基因密碼: A A-NN-HH6-FG-QQ-LP 標購者: 李明忠 成交價: 49,000元	福昌 L1037-05公 父1209-11 母0362-13 生日: 2016/8/29 基因密碼: A A-MN-LL0-FF-QQ-PP 標購者: 邱一慶 成交價: 67,000元	福昌 L1081-11母 父1711-06 母1745-12 生日: 2016/10/23 基因密碼: A A-NN-LL2-FF-QQ-LL 標購者: 羅復興 成交價: 17,000元	福昌 Y1270-12母 父1121-04 母1158-13 生日: 2016/6/30 基因密碼: A A-MM-HL4-FF-QQ-LP 標購者: 黃登玉 成交價: 22,000元	金龍 L0640-02母 父1384-09 母1484-07 生日: 2016/7/8 基因密碼: A A-NN-HL4-FF-QQ-LL 標購者: 羅復興 成交價: 32,000元
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2005~2014 Two Trait Index for L, Y, and D Breeds at 270 Days of Age

Adjusted ADG (aADGkg) = (Body Weight in Kg / Age in days old) + ((Day - BWkg)/(Day + BWkg))
Double Traits of Body weight and Backfat thickness Index (BAG index)
 BAG = (BWkg / ABFcm) + 250*(aADGkg - mean aADGkg) - 60*(ABFcm - mean ABFcm)

2015~Present

BAG_new = 1.52*(BWkg / BFcm at the fourth rib) + 250*(aADGkg - mean aADGkg) - 60*(ABFcm - mean ABFcm)