豬肉品質（種豬的貢獻）

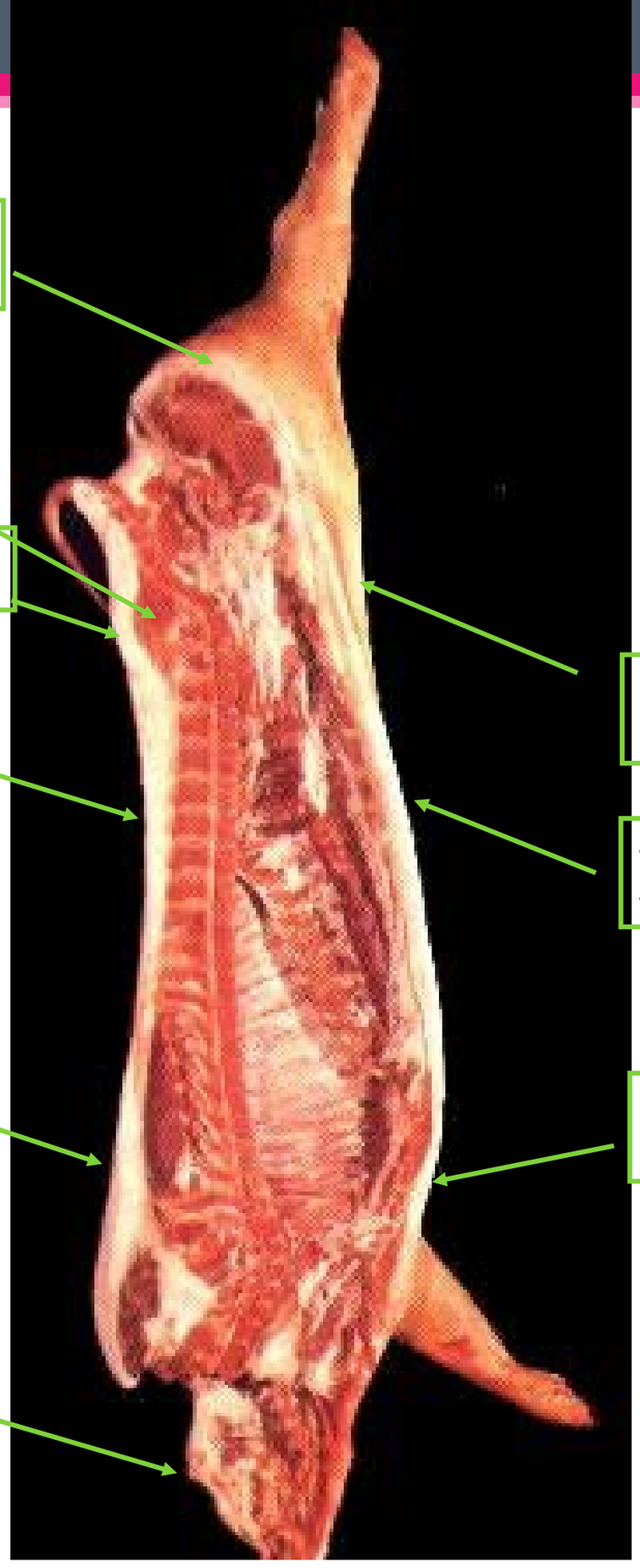
東海大學畜產與生物科技學系　吳勇初

Table 1. 台灣每年每人食肉消耗量

Years	豬肉	牛肉	羊肉	禽肉	其他	總和
2005	39.40(51.09%)	3.63	1.62	32.28	0.19	77.12
2006	39.95(50.61%)	3.90	1.53	33.52	0.04	78.94
2007	38.59(51.88%)	3.81	1.40	30.54	0.04	74.38
2008	37.30(51.41%)	3.87	1.56	29.80	0.03	72.55
2009	38.11(51.69%)	4.19	1.11	30.28	0.03	73.72
2010	37.07(49.05%)	4.91	1.29	32.26	0.04	75.57




Pork Carcass



Ham Collar

Lumbar Lean

Last Lumbar Vertebrae

Last Rib

First Rib

Jowl

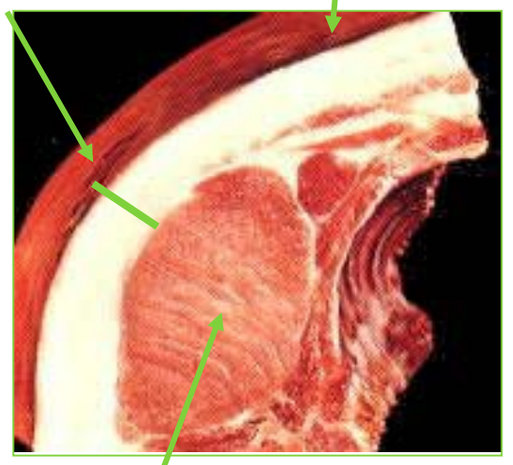
Belly Pocket

Navel Edge

Sternum

Loin Edge

Fat Opposite 10th rib



Loineye

Dressing yield

Carcasses did not include the head, leaf fat, kidneys or central diaphragmatic tendon, but did include the skirt.

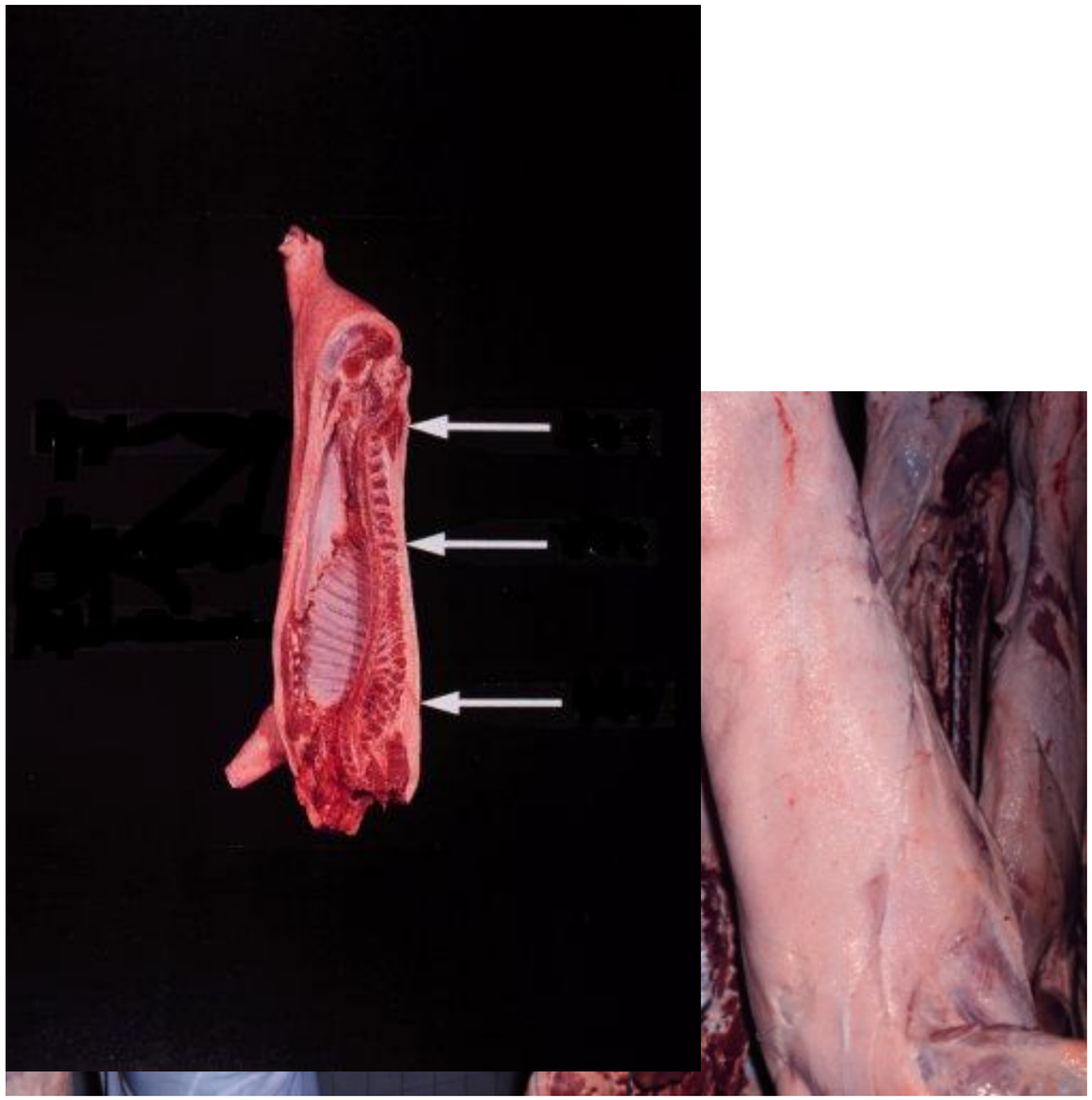
Carcass weight

The carcass yield is the proportion between the carcass weight and the live BW at slaughter.

$\% =$ (Carcass weight/Live weight) $\times 100$

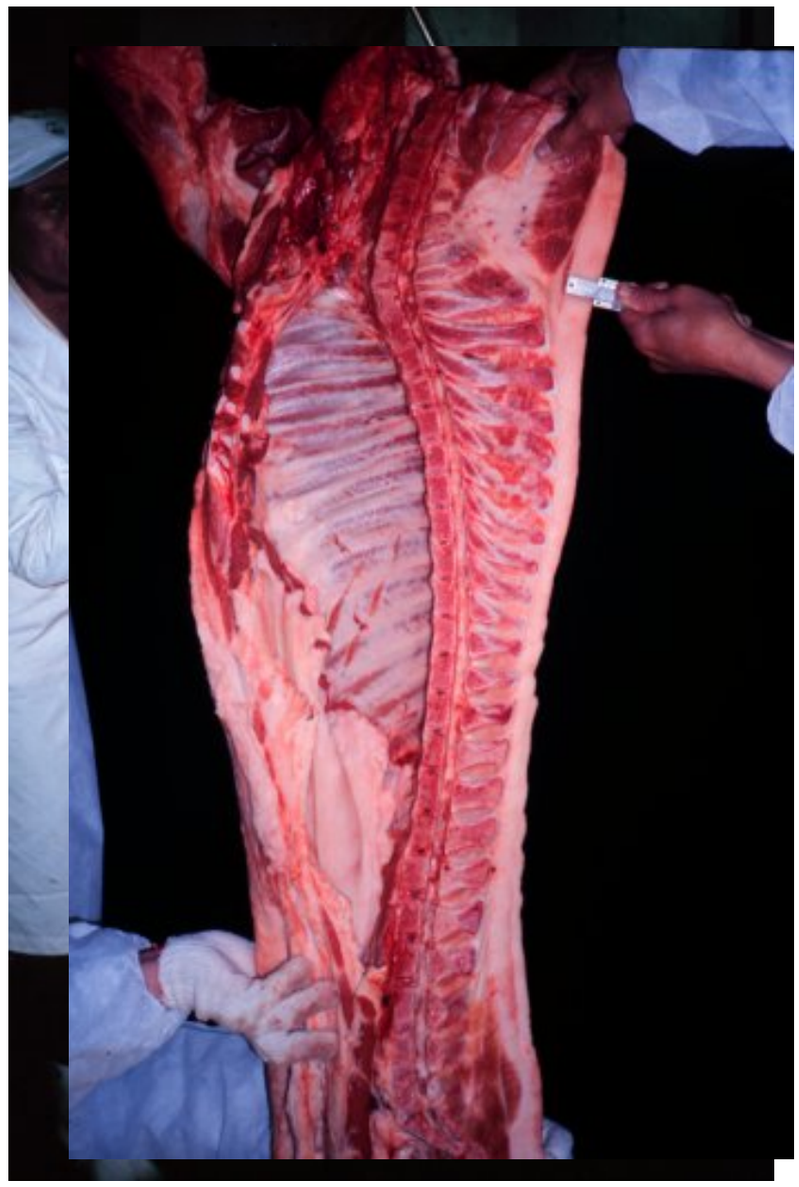
Fat thickness

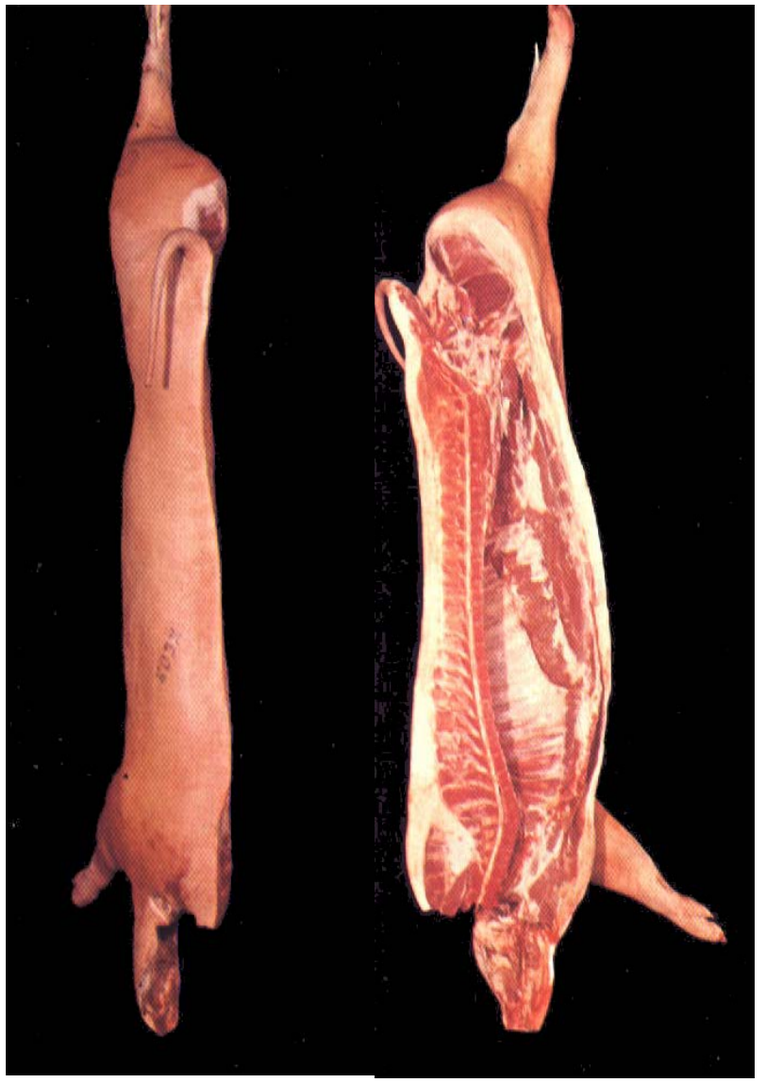
Backfat thickness was measured with a ruler.



Carcass length

Carcass length is measured from the posterior edge of the symphysis pubis to the anterior edge of the first rib.





品系

性別

體重

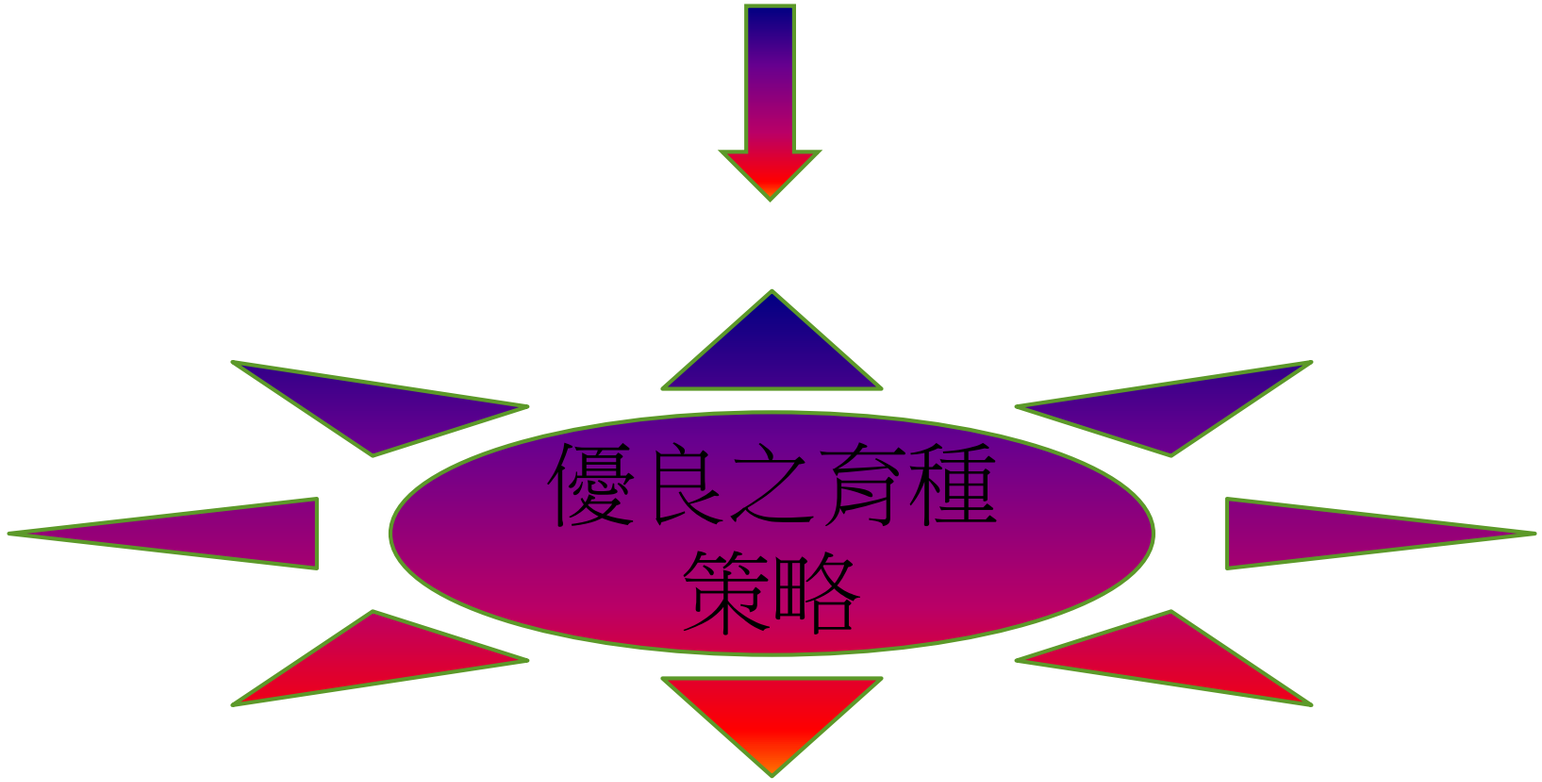
飼糧

日齡

試驗目的

- 目前上市肉豬品種主要以杜洛克種、藍瑞斯種所培育出之二品種雜交豬為主，平均屠宰時活體重皆較口蹄疫發生前的100-110 kg高，平均約為122 kg（中央畜產會，2011）。然而不同豬隻品種、性別與屠宰時活體重與屠肉品質息息相關，如何再獲得較佳的豬隻屠體性能與肉質性狀間取得平衡點，以達到飼養戶與加工業者於經濟獲利效益上的雙贏，為本試驗之發想之初衷。因此試驗主要探討台灣不同品種、性別與屠宰時活體重對於屠體性狀與肉質性狀之影響，以建立豬隻屠體資料庫提供產官學界之參考。

台灣各豬種屠體、肉質特性




品種
性別
體重

Taiwan Commonly Pig Breeds

Duroc

Origin in the eastern United States and in the Corn Belt

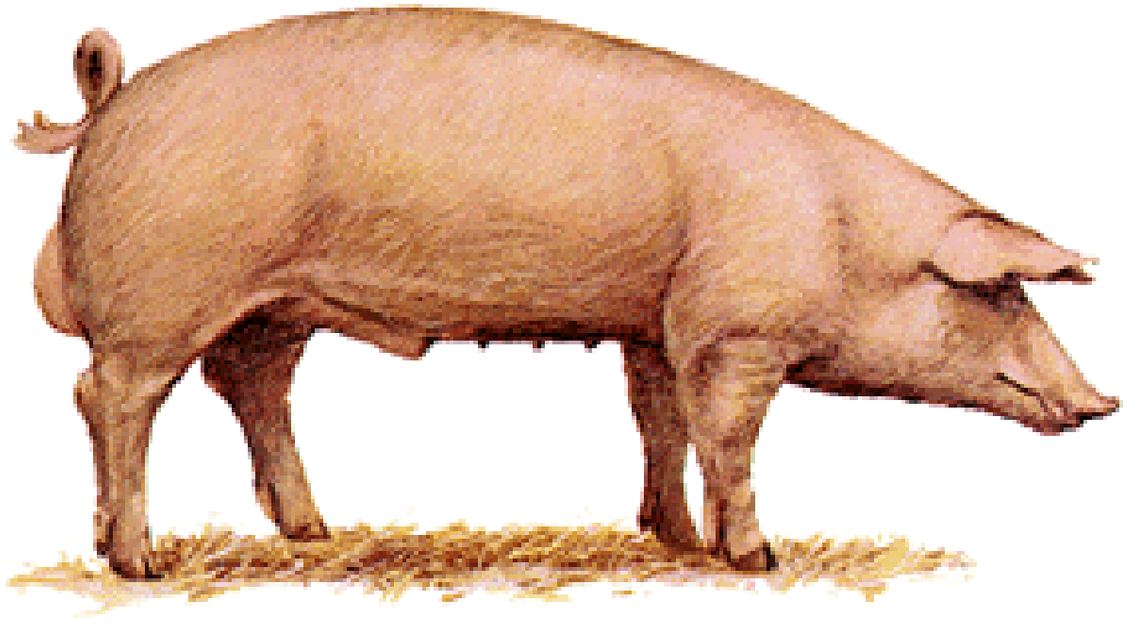
- ✓Red
- ✓Large-framed
- ✓Medium length
- ✓Muscular
- ✓Excellent feed conversion rate

provided by National Swine Registry

Landrace

Origin in the Danish

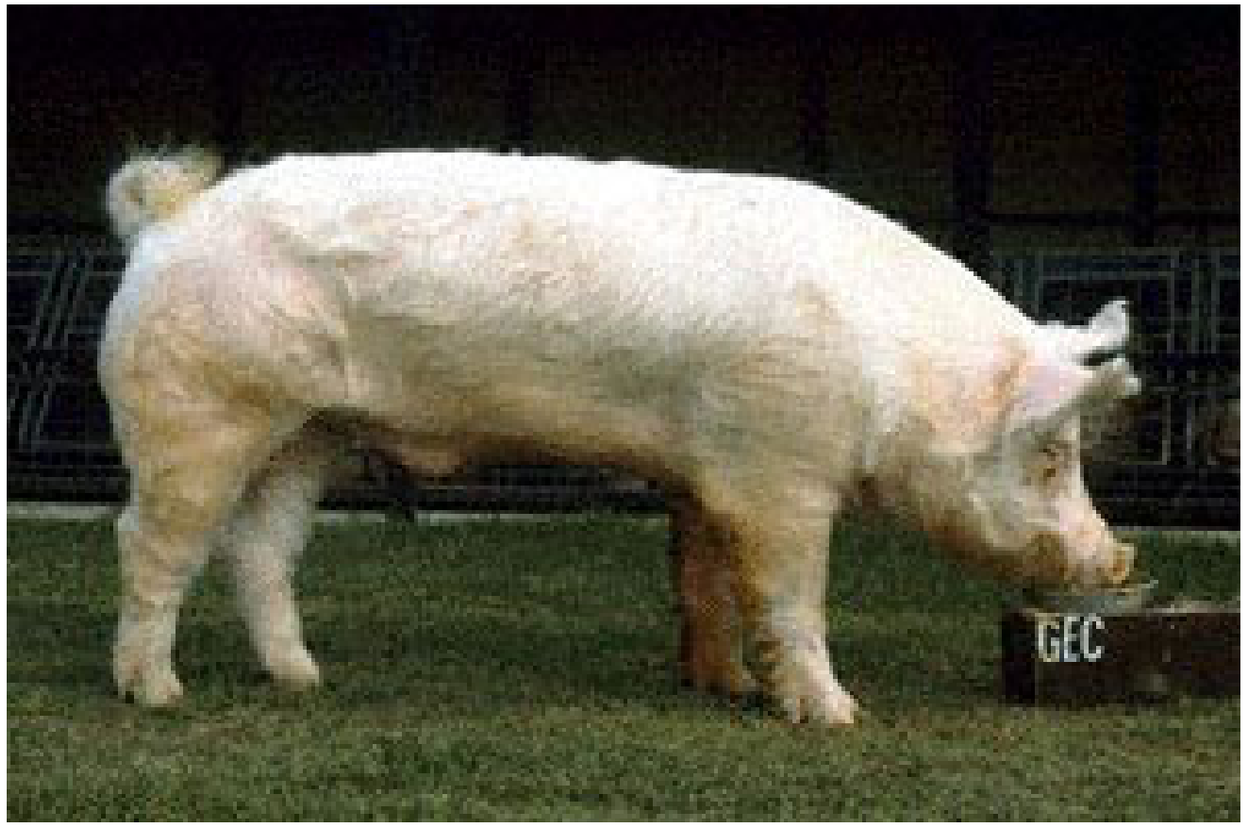
- ✓White
- ✓Large-framed
- ✓Longer carcass length
- ✓High fertility
- ✓Excellent motherhood



Yorkshire

Origin in the England

- ✓White
- ✓Large-framed
- ✓Longer carcass length
- ✓High fertility



閹公豬(Barrows) versus 女豬(Gilts)

Item	Gender			Reference
屠體長	Barrows	<	Gilts	（黃等，1984） （羅與黃，1995） （Larzul et al., 1997 ） （Weatherrup et al., 1998） （呂等，2000） （Tischendorf et al., 2002） （Cassady et al., 2004） （蘇等，2004）
背脂厚度(mm)	Barrows	>	Gilts	
腰眼面積	Barrows	<	Gilts	
肩胛肉重	Barrows	<	Gilts	
里肌肉重	Barrows	<	Gilts	
瘦肉率	Barrows	<	Gilts	
Etc…				


品種
性別
體重

Table 2. 屠宰體重對於伊比利亞豬生長性狀之影響

Breed	BW,kg	ADG,g	ADFI,g	FCR	Reference
Iberian Torbiscal	23.5 to 99.7	457.0	2,500	5.47	Daza *et al.* (2007)
	71.7 to 101.4	178.0	1,500	8.43	
	81.6 to 102.6	126.0	1,300	10.32	
White	60.1 to 114.3	737	2,382	3.24	Peinado *et al.* (2008)
	60.9 to 122.0	703	2,387	3.40	

Table 3. 屠體重對於大白豬屠體性狀之影響

屠宰時活體重, kg	114	122	Probability
屠體重, kg	90.2	96.8	***
屠宰率, %	79.1	79.6	+
脂肪厚度, mm			
背脂厚度	23.0	24.0	NS
後腿脂肪厚度	19.3	21.1	*
重量, kg			
後腿重	23.9	25.5	***
肩胛肉重	13.6	14.7	***
里肌肉重	6.4	6.7	***
總瘦肉重	43.6	46.7	***
產率, % carcass			
後腿肉	26.6	26.3	NS
肩胛肉	15.0	15.3	NS
里肌肉	7.1	7.0	NS
瘦肉率	48.6	48.6	NS
屠體長, cm	83.2	87.6	***
失重率, %			
後腿肉	1.21	0.99	***
肩胛肉	1.20	0.85	***

NS P ＞ 0.10; + P<0.10; * P<0.05; *** P<0.001.

(Peinado *et al.*, 2008)

Table 4. 屠宰體重對於肌間脂肪含量之影響

Slaughter weight, kg	Muscle	Fat, g fat/100 g moisture free tissue
1.25±0.07	LM	2.40±0.01
14.31±2.79		12.87±3.9
56.00±1.85		22.00±3.06
76.63±8.45		25.80±4.78
83.25±7.07		27.93±6.14
96.88±4.82		26.14±5.55
152.75±3.65		24.44±3.60
1.25±0.07	BF	-
14.31±2.79		9.82±1.82
56.00±1.85		9.35±1.72
76.63±8.45		10.90±2.27
83.25±7.07		21.26±5.48
96.88±4.82		16.89±2.25
152.75±3.65		21.24±3.47

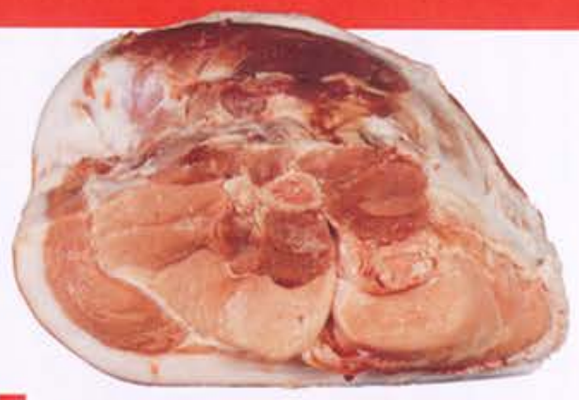
What’s meat quality?

PORK QUALITY STANDARDS

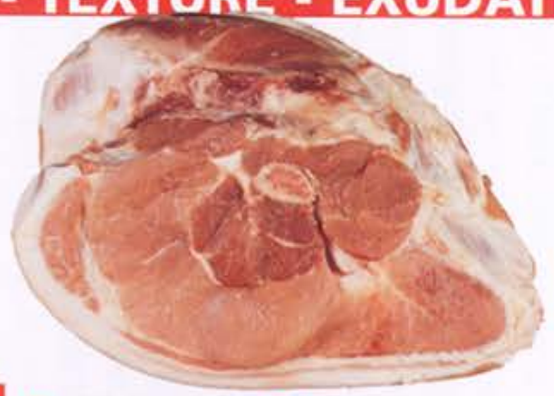
Quality of fresh pork varies greatly. The quality levels shown below will appear differently to consumers, taste differently when cooked, and perform differently when converted to processed products. High quality pork has greater monetary value than low quality pork. Quality can be evaluated by simply visual appraisal, or it can be determined more accurately by scientific tests. This chart may be used to help identify variations in pork quality. Color and Marbling Standards cards are also available.

pork The Other White Meat.®

COLOR - TEXTURE - EXUDATION



PSE Pale pinkish gray, very Soft and Exudative. Undesirable appearance and shrinks excessively.



RFN Reddish pink, Firm and Non-exudative. "IDEAL". Desirable color, firmness and water-holding capacity.

DFD Dark purplish red, very Firm and Dry. Firm and sticky surface, high water-holding capacity

COLOR STANDARDS

1.0	2.0	3.0	4.0	5.0	6.0
Pale pinkish gray to white	Grayish pink	Reddish pink	Dark reddish pink	Purplish red	Dark purplish red
Minolta L* Value[1] 61	55	49	43	37	31

MARBLING STANDARDS[2]

1.0	2.0	3.0	4.0	5.0	6.0	10.0

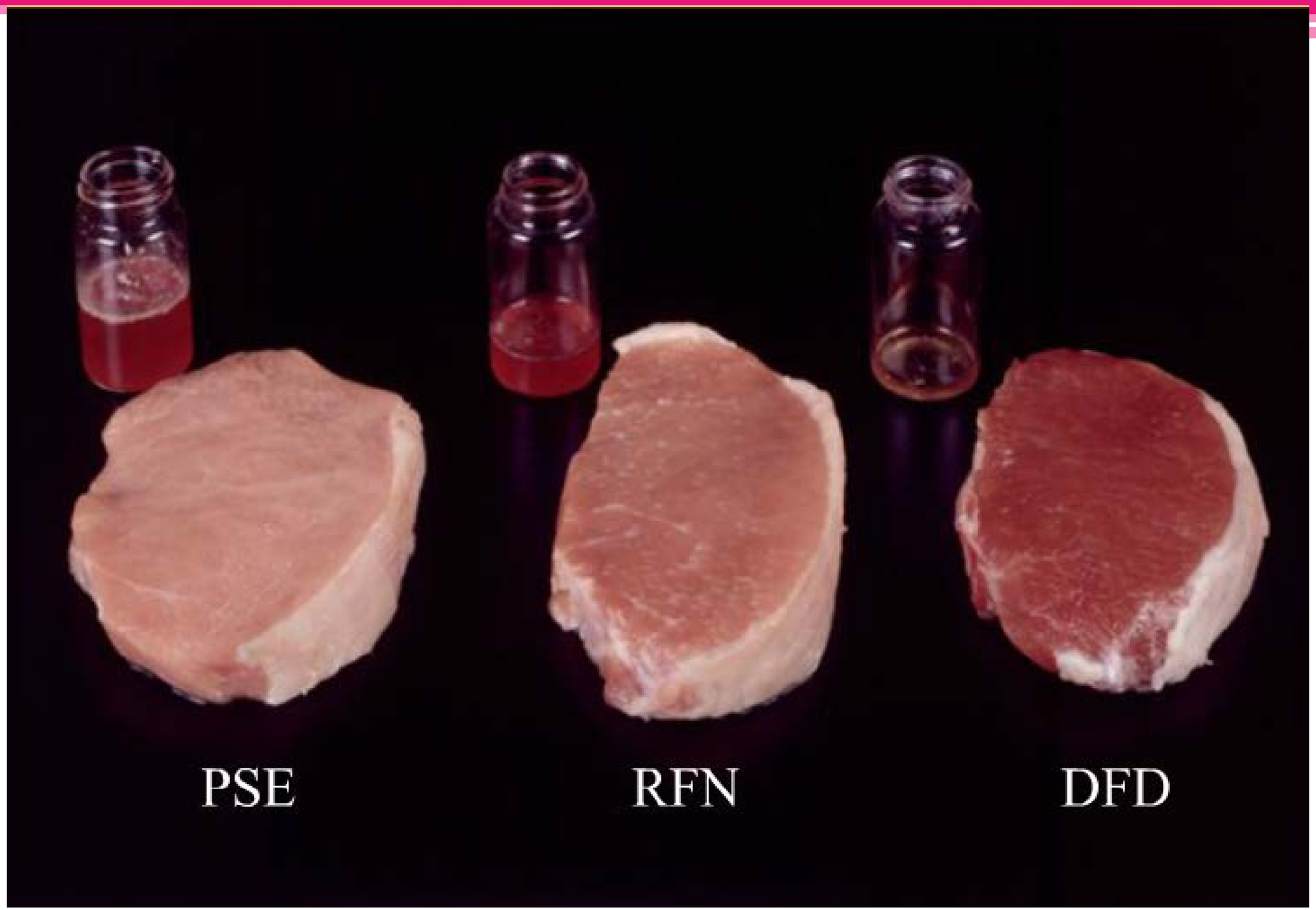
Color and marbling scores are as described in "Composition & Quality Assessment Procedures", 1999, NPPC.

1 Minolta L* values use D65 daylight light source.

2 Marbling scores correspond to intramuscular lipid content

For more information contact:
National Pork Producers Council
P.O. Box 10383
Des Moines, Iowa 50306 USA
(515) 223-2600
www.nppc.org

Pork Checkoff Works.



Color & Drip Loss Relationship

肉質優劣判斷

Processing

酸鹼值

保水力(WHC)

Cooking loss

Proximate analysis

Taste

ATP-ralated compounds content

Shear value

Sensory evaluation

Proximate analysis

Fatty acid composition

肉質性狀

屠體性狀

生長性狀

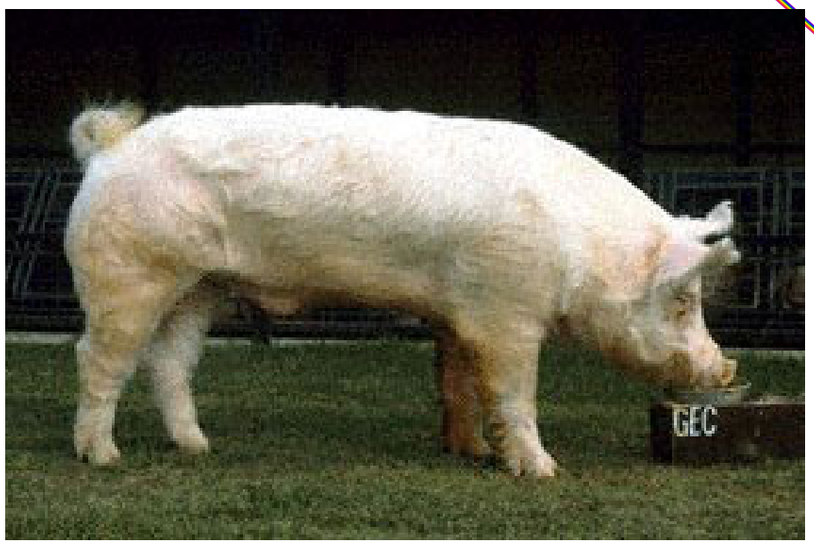
- ✓品種
- ✓性別
- ✓體重

- 材料方法

- 因優良種豬取得不易，故以種公豬之同源親代為此次試驗目標。
- 來自7個種豬場所提供之L、Y、D之純種閹公豬與女豬共370隻，試驗豬隻 體重約 90-120kg。試驗豬隻在台灣農畜產工業股份有限公司進行屠宰。

A total of 370 pigs

Yorkshire



Barrows

Gilts

- Carcass weight
- Dressing yield
- Carcass length
- Backfat thickness
- Loin eye area
- Weight of commercial cuts
- Lean percentage
- Loin Color
- Loin Marbling
- Loin Firmness
- Proximate analysis
- WHC
- pH

Pigs slaughtered at 110.1-120 Kg

D -L- Y ♂

- ✓L*ab* color difference, Marbling, Firmness
- ✓Shear value & Texture profile analysis
- ✓ATP-related compounds content
- ✓Free amino acid content
- ✓Muscle fiber number
- ✓Fatty acid composition & Melting point
- ✓Cooking loss
- ✓Sensory evaluation

D -L- Y ♀

Table 5. Effects of pig's breeds and sexes on selected carcass measurements

Carcass length : Landrace
Backfat thickness :Landrace
Loineye area : Duroc
Yorkshire

								ificant	
								S	B×S
活體重Body weight								NS	NS
屠體重Carcass weig								NS	NS
屠宰率Dressing yield	85.52	85.91	86.19	86.34	84.98	85.05	0.53	NS	NS	NS
屠體長Carcass length	$81.71^{b,y}$	$82.72^{b,x}$	$83.93^{a,y}$	$84.76^{a,x}$	$81.94^{b,y}$	$82.52^{b,x}$	0.51	**	*	NS
第一肋背脂厚P1BF(cm)	$3.27^{b,x}$	$2.98^{a,y}$	$3.21^{b,x}$	$2.79^{b,y}$	$3.54^{a,x}$	$3.01^{a,y}$	0.28	**	**	NS
最後肋背脂厚P2BF(cm)	$1.97^{b,x}$	$1.84^{b,y}$	$1.88^{c,x}$	$1.72^{c,y}$	$2.11^{a,x}$	$1.97^{a,y}$	0.17	**	**	NS
最後腰椎背脂厚P3BF(cm)	$1.88^{b,x}$	$1.79^{ab,y}$	$1.87^{b,x}$	$1.75^{b,y}$	$1.98^{a,x}$	$1.86^{a,y}$	0.11	**	**	NS
腰眼面積LEA (cm²)	$58.12^{a,y}$	$59.17^{a,x}$	$53.14^{b,y}$	$55.19^{b,x}$	$52.14^{b,x}$	$52.78^{c,x}$	1.46	**	**	NS

(B)Breeds; Duroc ; Landrace ; Yorkshire. (S)Sexes; Barrows; Gilts.
P1BF, Backfat thickness(1st rib) ; P2BF, Backfat thickness(last rib) ; P3BF, Backfat thickness(last lumbar) ; LEA, Loineye area.
NS: not significant, * $P < 0.05$, ** $P < 0.01$.
$^{a, b, c}$Values in the different breeds of the same sexes with different superscripts are significantly different ($P < 0.05$).
$^{x, y, z}$Values in the different sexes of the same breeds with different superscripts are significantly different ($P < 0.05$).

Table 6. Effects of pig's sexes and slaughter weights on selected carcass measurements

	Barrows				Gilts					**Significant**		
（Kg）	90.1-100	100.1-110	110.1-120	120.1-130	90.1-100	100.1-110	110.1-120	120.1-130	SEM	S	W	S×W
活體重Body weight	94.47^{d}	105.87^{c}	115.17^{b}	122.4^{a}	96.63^{d}	106.33^{c}	114.73^{b}	123.27^{a}	0.59	NS	**	NS
屠體重Carcass weight	80.53^{d}	91.07^{c}	99.30^{b}	104.37^{a}	82.90^{d}	92.27^{c}	99.77^{b}	104.93^{a}	0.48	NS	**	NS
屠宰率Dressing yield	85.07^{d}	85.73^{bc}	86.50^{a}	86.00^{b}	85.33^{c}	86.20^{b}	86.67^{a}	86.60^{a}	0.36	NS	**	NS
屠體長Carcass length	79.73^{d}	82.57^{c}	83.47^{b}	86.17^{a}	81.03^{d}	83.70^{c}	85.33^{b}	87.70^{a}	0.48	*	**	NS
第一肋背脂厚 P1BF(cm）	2.74^{d}	2.98^{c}	3.32^{b}	3.59^{a}	2.40^{c}	3.04^{b}	3.20^{ab}	3.29^{a}	0.21	**	**	NS
最後肋背脂厚 P2BF(cm）	1.89^{c}	1.91^{bc}	2.01^{b}	2.25^{a}	1.52^{d}	1.73^{c}	1.99^{b}	2.17^{a}	0.29	**	**	NS
最後腰椎背脂厚 P3BF(cm）	1.83^{c}	1.90^{c}	2.04^{b}	2.47^{a}	1.49^{c}	1.60^{b}	2.01^{a}	1.71^{b}	0.18	**	**	NS
腰眼面積LEA（cm^2）	51.03^{d}	53.90^{c}	58.17^{b}	61.97^{a}	53.67^{c}	58.43^{b}	58.77^{b}	63.20^{a}	0.39	**	**	NS

(S)Sexes ; Barrows ; Gilts. (W)Slaughter weights.
P1BF, Backfat thickness(1st rib) ; P2BF, Backfat thickness(last rib) ; P3BF, Backfat thickness(last lumbar) ; LEA, Loineye area.
NS: not significant, * $P < 0.05$, ** $P < 0.01$.
$^{a, b, c}$Values in the different weights of the same sexes with different superscripts are significantly different($P < 0.05$).

Table 7. Effects of pig's breeds and sexes on the front, middle and rare carcass composition

	Duroc		Landrace		Yorkshire			Significant		
	Barrows	Gilts	Barrows	Gilts	Barrows	Gilts	SEM	B	S	B×S
前段部位 Front part										
Lean weight（kg）	8.736^{a}		8.683^{a}		8.426^{ab}		0.67	**	NS	NS
Fat weight（kg）	1.799^{c}		1.923^{b}		2.156^{a}		0.22	**	NS	NS
Lean:Fat	4.76^{a}		4.67^{a}		3.92^{b}		0.17	**	*	NS
Lean:Bone	2.66^{a}		2.43^{b}		2.22^{c}		0.14	*	NS	NS
中段部位 Middle part										
Lean weight（kg）	8.123^{b}		8.436^{a}		8.692^{a}		0.67	**	NS	NS
Fat weight（kg）	2.095^{b,x}		1.736^{c,x}		2.532^{a,x}		0.29	**	*	NS
Lean:Fat	3.86^{b,y}		4.17^{a,y}		3.66^{c,y}		0.19	*	*	NS
Lean:Bone	3.98^{b,y}		4.53^{a,y}		3.67^{c,x}		0.13	**	*	NS
後段部位 Rare part										
Lean weight（kg）	8.902^{a,x}		8.636^{b,y}		8.123^{c,y}		0.71	**	*	NS
Fat weight（kg）	1.523^{b,x}		1.543^{b,x}		1.756^{a,x}		0.39	*	*	NS
Lean:Fat	5.86^{a,y}		5.59^{b,x}		4.62^{c,y}		0.14	*	*	NS
Lean:Bone	4.01		4.06		3.70		0.21	NS	NS	NS

(B)Breeds ; Duroc ; Landrace ; Yorkshire. (S)Sexes; Barrows ; Gilts.

NS: not significant, * $P < 0.05$, ** $P < 0.01$.

$^{a, b, c}$Values in the different breeds of the same sexes with different superscripts are significantly different ($P < 0.05$).

$^{x, y, z}$Values in the different sexes of the same breeds with different superscripts are significantly different ($P < 0.05$).

Table 8. Effects of pig's sexes and slaugher weights on the front, middle and rare carcass composition

	Barrows				Gilts					Significant		
(KG)	90.1-100	100.1-110	110.1-120	120.1-130	90.1-100	100.1-110	110.1-120	120.1-130	SEM	S	W	S×W
前段部位 Front part												
Lean weight（kg）	7.542^{d}	8.525^{c}	9.054^{b}	10.055^{a}	7.821^{d}	8.633^{c}	9.418^{b}	10.419^{a}	0.41	NS	**	NS
Fat weight（kg）	1.635^{d}	1.793^{c}	2.088^{b}	2.342^{a}	1.436^{c}	1.685^{b}	2.166^{a}	2.207^{a}	0.11	NS	**	NS
Lean:Fat	4.76^{a}	4.75^{a}	4.54^{b}	4.38^{c}	$5.44b^{c}$	5.69^{a}	4.46^{b}	4.57^{ab}	0.12	*	*	NS
Lean:Bone	2.47^{d}	2.63^{c}	2.72^{b}	2.73^{a}	2.67^{bc}	2.70^{b}	2.79^{ab}	2.85^{a}	0.19	NS	**	NS
中段部位 Middle part												
Lean weight（kg）	7.737^{d}	8.763^{c}	9.736^{b}	10.252^{a}	7.989^{d}	8.968^{c}	9.751^{b}	10.380^{a}	0.41	NS	**	NS
Fat weight（kg）	1.446^{d}	1.679^{c}	2.513^{a}	2.195^{b}	1.351^{d}	1.651^{c}	1.917^{b}	2.113^{a}	0.22	*	**	*
Lean:Fat	5.84^{a}	5.87^{a}	4.33^{c}	4.74^{b}	6.21^{a}	5.92^{b}	5.30^{c}	4.95^{d}	0.11	*	*	NS
Lean:Bone	3.61^{c}	3.89^{b}	4.20^{a}	4.12^{a}	3.76^{d}	3.97^{c}	4.64^{a}	4.52^{b}	0.09	*	**	NS
後段部位 Rare part												
Lean weight（kg）	7.564^{d}	8.231^{c}	8.990^{b}	9.456^{a}	7.913^{d}	8.664^{c}	8.952^{b}	9.582^{a}	0.17	*	**	NS
Fat weight（kg）	1.210^{b}	1.253^{b}	1.878^{a}	1.928^{a}	0.966^{c}	0.940^{c}	1.608^{b}	1.799^{a}	0.11	*	**	NS
Lean:Fat	7.34^{a}	7.05^{b}	5.76^{c}	5.59^{d}	8.40^{a}	7.19^{b}	5.90^{c}	5.84^{c}	0.26	*	**	NS
Lean:Bone	4.43^{c}	4.64^{b}	4.68^{b}	4.90^{a}	4.54^{c}	4.78^{b}	4.95^{a}	5.01^{a}	0.11	NS	*	NS

Lean weight
Fat weight
Lean:Bone
Lean:Fat

(S)Sexes ; Barrows ; Gilts. (W)Slaughter weights.
NS: not significant, * $P < 0.05$, ** $P < 0.01$.
$^{a, b, c}$Values in the different weights of the same sexes with different superscripts are significantly different ($P < 0.05$).

Loin weight : Barrows < Gilts
Lean percentage : Barrows < Gilts

Shoulder weight:L > D > Y
Picnic weight:D > L > Y
Loin weight:L > D > Y
Belly weight:Y > L > D
Ham weight:D > L > Y
Lean percentage :L > D > Y

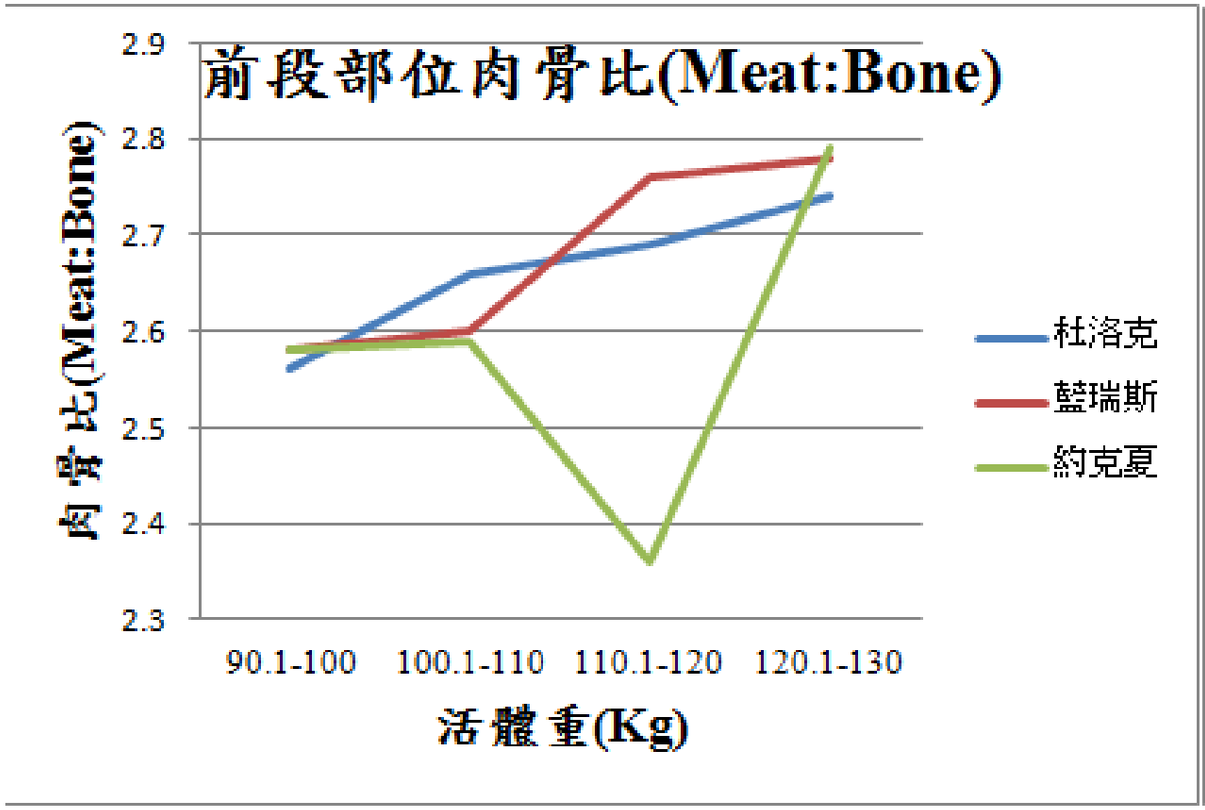
肩胛肉 Shoulder weight(kg)	2.39^{a}	2.41^{a}	2.40^{a}	2.51^{a}	2.07^{b}	2.19^{b}	0.45	**	NS	NS
前腿肉 Picnic weight(kg)	5.64^{a}	5.78^{a}	5.57^{a}	5.63^{a}	5.23^{b}	5.21^{b}	0.73	**	NS	NS
背脊肉 Loin weight(kg)	3.42^{b,x}	3.48^{b,x}	3.99^{a,y}	4.21^{a,x}	3.17^{c,x}	3.21^{c,x}	0.97	**	*	NS
小里肌 Tenderloin weight(kg)	0.51	0.52	0.52	0.49	0.51	0.52	0.11	NS	NS	NS
腹脇肉 Belly weight(kg)	4.98^{c}	4.82^{c}	5.12^{b}	5.21^{ab}	5.34^{a}	5.31^{a}	0.51	**	NS	**
後腿肉 Ham weight(kg)	8.89^{a}	8.92^{a}	8.57^{b}	8.44^{b}	8.12^{c}	8.26^{c}	0.11	**	NS	NS
瘦肉率 Lean percentage(%)	57.67^{b,y}	57.98^{b,x}	58.42^{a,y}	58.74^{a,x}	56.13^{c,y}	56.80^{c,x}	0.42	**	*	NS

(B)Breeds ; Duroc ; Landrace ; Yorkshire. (S)Sexes ; Barrows ; Gilts.
NS: not significant, * $P < 0.05$, ** $P < 0.01$.
$^{a, b, c}$Values in the different breeds of the same sexes with different superscripts are significantly different ($P < 0.05$).
$^{x, y, z}$Values in the different sexes of the same breeds with different superscripts are significantly different ($P < 0.05$).

Table 10. Effects of pig's sexes and slaughter weights on the distribution of primal cuts weight

	Barrows				Gilts					Significant		
(KG)	90.1-100	100.1-110	110.1-120	120.1-130	90.1-100	100.1-110	110.1-120	120.1-130	SEM	S	W	S×W

(S)Sexes ; Barrows; Gilts. (W)Slaughter weights.
NS: not significant, * $P < 0.05$, ** $P < 0.01$.
[a, b, c]Values in the different weights of the same sexes with different superscripts are significantly different ($P < 0.05$).



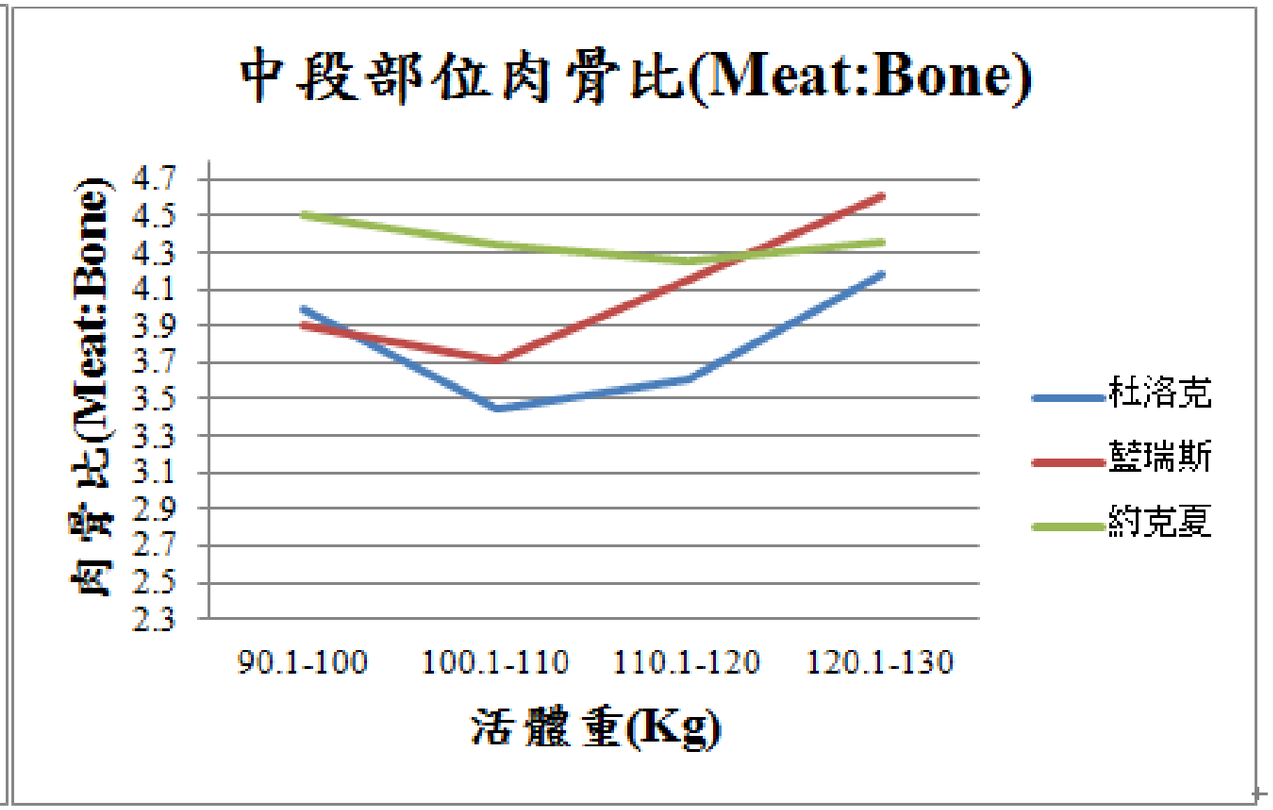


Fig. 2. Interaction of breeds and slaughter weights on rare part and middle part meat:bone in pigs.

- 小結

Dourc

- ✓Loineye area
- ✓Picnic weight
- ✓Ham weight
- ✓Front part Meat:Fat & Meat:Bone
- ✓Rare part Meat:Fat & Meat:Bone

Landrace

- ✓Carcass length
- ✓Thinner backfat thickness
- ✓ Loin weight
- ✓Highest percentage of total lean
- ✓Middle part Meat:Bone

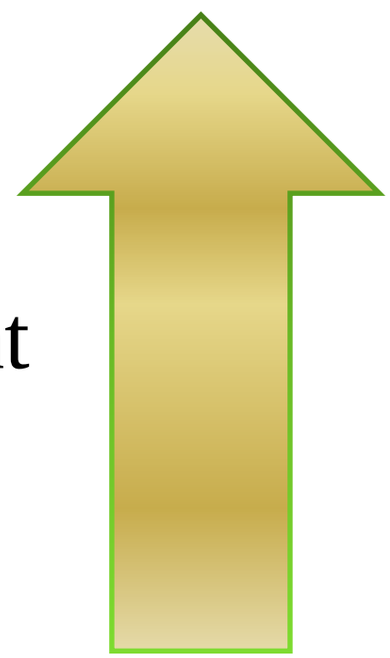
Yorkshire

- ✓Thicker backfat thickness
- ✓Belly weight
- ✓Lowest percentage of total lean

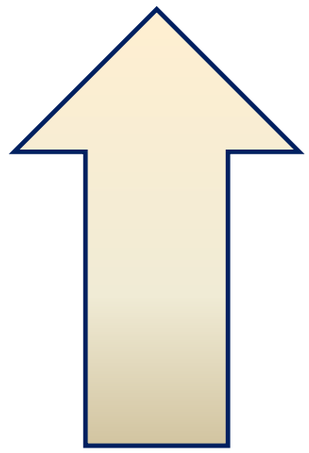
Carcass length
Backfat performance
Loineye area
Loin weight
Lean percentage

Barrows < **Gilts**

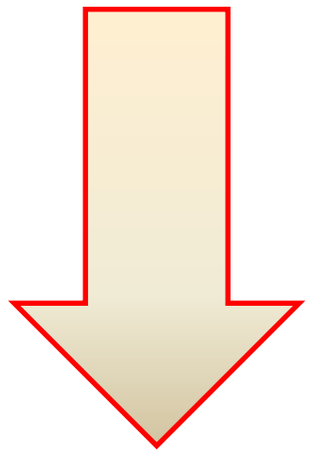
Slaughter weight



Backfat thickness
Carcass length
Dressing yield
Loineye area
Primal cuts weight



Lean percentage



Correlation analysis of carcass traits

For exp. Duroc barrows

	活體重	屠體重	屠宰率	屠體長	第1肋	最後肋	最後腰椎	腰眼面積	瘦肉率	總瘦肉重
屠體重	0.98*									
屠宰率	0.23	0.36								
屠體長	0.66*	0.60*	-0.19							
第1肋	0.48*	0.43*	0.23	0.31*	.					
最後肋	0.42*	0.41*	0.21	0.33*	0.48*					
最後腰椎	0.39*	0.38*	0.17	0.32*	0.43*	0.37*				
腰眼面積	0.39*	0.31*	-0.11	0.36*	0.17	-0.10	-0.12			
瘦肉率	-0.43*	-0.45*	0.12	0.36*	-0.33*	-0.29	-0.38*	0.19		
總瘦肉重	0.36*	0.42*	0.13	0.37*	0.17	0.11	0.27	0.37*	-0.21	

* $P < 0.05$

Table 11. Effects of pig's breeds and sexes on proximate analysis, WHC, and pH of LD muscle

	Duroc		Landrace		Yorkshire			Significant		
	Barrows	Gilts	Barrows	Gilts	Barrows	Gilts	SEM	B	S	B×S
水分 Water	74.17	74.21	74.38	74.55	74.21	74.29	0.15	NS	NS	NS
蛋白質 Protein	22.88^{y}	23.32^{x}	23.01^{y}	23.92^{x}	22.72^{y}	23.11^{x}	0.23	NS	*	NS
脂肪 Fat	$1.92^{a,x}$	$1.73^{a,y}$	$1.61^{b,x}$	$1.31^{c,y}$	$1.62^{b,x}$	$1.56^{b,x}$	0.11	*	*	NS
灰分 Ash	1.38	1.39	1.22	1.29	1.27	1.31	0.05	NS	NS	NS
保水力 WHC	$68.14^{a,y}$	$69.56^{a,x}$	$68.22^{a,x}$	$68.45^{b,x}$	$67.12^{b,x}$	$67.23^{c,x}$	0.36	*	*	NS
蒸煮失重 Cooling loss	$18.71^{b,x}$	$17.23^{c,y}$	$18.66^{b,y}$	$19.19^{b,x}$	$21.14^{a,x}$	$20.33^{a,y}$	0.55	*	*	NS
Ham pH1	6.42^{a}	6.47^{a}	6.21^{b}	6.22^{b}	6.17^{b}	6.23^{b}	0.12	*	NS	NS
Ham pH24	6.23^{a}	6.26^{a}	6.01^{b}	6.14^{b}	6.02^{b}	6.11^{b}	0.11	*	NS	NS
Loin pH1	6.31^{a}	6.29^{a}	6.01^{b}	6.11^{b}	6.01^{b}	5.99^{b}	0.09	*	NS	NS
Loin pH24	6.17^{a}	6.11^{a}	5.87^{b}	5.92^{b}	5.88^{b}	5.93^{b}	0.17	*	NS	*

(B)Breeds ; Duroc ; Landrace ; Yorkshire. (S)Sexes ; Barrows ; Gilts.
NS: not significant, * $P < 0.05$, ** $P < 0.01$.
$^{a, b, c}$Values in the different breeds of the same sexes with different superscripts are significantly different ($P < 0.05$).
$^{x, y, z}$Values in the different sexes of the same breeds with different superscripts are significantly different ($P < 0.05$).

Table 12. Effects of pig's sexes and slaughter weights on proximate analysis, WHC, and pH of LD muscle

	Barrows				Gilts					Significant		
(KG)	90.1-100	100.1-110	110.1-120	120.1-130	90.1-100	100.1-110	110.1-120	120.1-130	SEM	S	W	S×W
水分 Water	74.43^{a}	74.01^{b}	73.79^{c}	73.75^{c}	74.46^{a}	74.17^{b}	74.50^{a}	73.56^{c}	0.1	NS	*	NS
蛋白質 Protein	22.55^{a}	22.13^{b}	22.00^{bc}	21.76^{c}	23.08^{a}	22.61^{b}	22.44^{c}	22.54^{bc}	0.1	*	*	NS
脂肪Fat	1.08c	1.72^{b}	1.75^{b}	2.47^{a}	0.54^{d}	0.80^{c}	1.20^{a}	1.04^{b}	0.03		*	NS
灰分Ash	1.23	1.20	1.23	1.23	1.23	1.23	1.20	1.27	0.04	NS	NS	NS
保水力 WHC	67.29	67.21	67.17	68.15	68.36	68.30	68.24	68.95	0.31	*	NS	NS
Ham pH1	6.34	6.32	6.29	6.25	6.33	6.33	6.30	6.20	0.07	NS	NS	NS
Ham pH24	6.28	6.09	6.14	6.19	6.40	6.35	6.20	6.26	0.09	NS	NS	NS
Loin pH1	5.93	5.97	5.81	5.86	6.02	5.99	5.94	5.94	0.11	NS	NS	NS
Loin pH24	5.88	5.95	5.80	5.89	5.88	5.97	5.94	5.90	0.23	NS	NS	NS

S)Sexes ; Barrows ; Gilts. (W)Slaughter weights.
NS: not significant, * $P < 0.05$, ** $P < 0.01$.
$^{a, b, c}$Values in the different weights of the same sexes with different superscripts are significantly different ($P < 0.05$).

Correlation of meat proximate analysis of LD muscle

	水分	蛋白質	脂肪	保水力	蒸煮失重	Loin pH1	Loin pH24
水分							
蛋白質	0.27						
脂肪	-0.65*	-0.59*					
保水力	0.33	0.42*	-0.11				
蒸煮失重	0.27	-0.11	0.19	-0.52*			
Loin pH1	0.13	0.09	0.12	0.37	-0.27		
Loin pH24	0.18	0.07	0.14	0.46*	-0.33	0.58*	

* $P < 0.05$

Table 13. Effects of pig's breeds and sexes of on meat quality evaluation of LD muscle

Marbling : Barrows ＞ Gilts
Yellowness : Barrows ＞ Gilts
Redness : Barrows ＜ Gilts

	B					EM	Significant		
							B	S	B*S
肉色 Color	5					.12	*	NS	NS
大理石紋 Marbling	2.66^{a,x}	1.72^{a,y}	2.05^{b,x}	1.69^{ab,y}	1.78^{c,x}	1.66^{b,y}	0.11	*	*	NS
緊實度 Firmness	2.98^{a}	2.88^{a}	2.85^{b}	2.78^{b}	2.43^{c}	2.59^{c}	0.23	*	NS	NS
亮度值 (Lightness, L)	50.18^{b}	49.58^{b}	49.58^{c}	49.55^{b}	51.48^{a}	52.48^{a}	0.34	*	NS	*
紅色值 (Redness, *a*)	7.89^{a,y}	8.96^{a,x}	7.64^{b,y}	8.24^{b,x}	4.66^{c,y}	5.78^{c,x}	0.16	*	*	NS
黃色值 (Yellowness, *b*)	9.74^{a,x}	8.77^{a,y}	7.99^{b,x}	8.01^{b,x}	7.12^{c,x}	6.48^{c,y}	0.24	*	*	NS

(B)Breeds ; Duroc ; Landrace ; Yorkshire.(S)Sexes ; Barrows ; Gilts.
NS: not significant, * $P < 0.05$, ** $P < 0.01$.
$^{a, b, c}$Values in the different breeds of the same sexes with different superscripts are significantly different ($P < 0.05$).
$^{x, y, z}$Values in the different sexes of the same breeds with different superscripts are significantly different ($P < 0.05$).

Correlation of meat quality characteristics of LD muscle

	肉色	大理石紋	緊實度	L（亮度值）	*a*（紅色值）	*b*（黃色值）	Loin pH24
肉色							
大理石紋	0.17						
緊實度	0.48*	0.32					
L（亮度值）	-0.33	0.29	-0.42*				
a（紅色值）	0.43*	-0.21	0.37	-0.27			
b（黃色值）	0.37	0.49*	0.21	0.38	0.25		
Loin pH24	0.52*	0.33	0.47*	-0.44*	0.32	0.22	

* $P < 0.05$

Table 14. Effects of pig's breeds and sexes on shear value, texture profile analysis, and muscle fiber number of LD muscle

	Duroc		Landrace		Yorkshire			Significant		
	Barrows	Gilts	Barrows	Gilts	Barrows	Gilts	SEM	B	S	B*S
肌纖維數目 Muscle fiber number	2						1.01	*	NS	NS
剪力質 Shear value	5.660^{c,y}	6.021^{c,x}	6.445^{b,x}	6.558^{b,x}	7.086^{a,y}	7.996^{a,x}	0.43	**	*	NS
硬度 Hardness	4.542^{c,y}	5.988^{c,x}	6.213^{b,x}	6.399^{b,x}	6.971^{a,y}	7.521^{a,x}	0.29	**	*	NS
內聚性 Cohesiveness	0.662	0.636	0.647	0.618	0.644	0.596	0.21	NS	NS	NS
彈性 Springiness	0.633	0.695	0.702	0.639	0.660	0.657	0.11	NS	NS	NS
咀嚼性 Chewiness	1.012	1.123	0.964	0.937	1.011	0.957	0.13	NS	NS	NS

Shear & Hardness : Barrows < Gilts

(B)Breeds; Duroc ; Landrace ; Yorkshire.(S)Sexes ; Barrows ; Gilts.

NS: not significant, * $P < 0.05$, ** $P < 0.01$.

$^{a, b, c}$Values in the different breeds of the same sexes with different superscripts are significantly different ($P < 0.05$).

$^{x, y, z}$Values in the different sexes of the same breeds with different superscripts are significantly different ($P < 0.05$).

Correlation analysis of texture analysis of loin

	Crude fat	Marbling	Shear value	Hardness	Muscle fiber number
Crude fat					
Marbling	0.69*				
Shear value	-0.52*	-0.48*			
Hardness	-0.47*	-0.39*	0.97*		
Muscle fiber number	0.37*	0.41*	-0.67*	-0.59*	
Tenderness	0.59*	0.44*	-0.72*	-0.66*	0.36*
Juiciness	0.64*	0.59*	-0.45*	-0.39*	0.41*
Sweetness	0.44*	0.47*	-0.39*	-0.42*	0.35*
Flavor	0.35*	0.43*	-0.39*	-0.36*	0.42*
Total acceptability	0.37*	0.33*	-0.68*	-0.55*	0.52*

* $P < 0.05$

Table 15. Effects of pig's breeds and sexes on ATP content of LD muscle (mg/g)

	Duroc		Landrace		Yorkshire			Significant		
	Barrows	Gilts	Barrows	Gilts	Barrows	Gilts	SEM	B	S	B*S
CMP	0.1437^{a,x}	0.1093^{a,y}	0.0391^{c,y}	0.0689^{b,x}	0.0643^{b,x}	0.0310^{c,y}	0.0011	**	*	*
UMP	0.0924	0.0650	0.0864	0.1099	0.0925	0.0853	0.0020	NS	NS	NS
ATP	0.0071	0.0097	0.0090	0.0086	0.0075	0.0074	0.0011	NS	NS	NS
ADP	0.0068	0.0069	0.0074	0.0080	0.0077	0.0068	0.0014	NS	NS	NS
GMP	0.0663	0.0522	0.0499	0.0423	0.0579	0.0531	0.0019	NS	NS	NS
IMP	1.3457^{a}	1.1173^{a}	0.6431^{b}	0.6343^{b}	0.5070^{c}	0.4888^{c}	0.0036	**	NS	NS
HYP	0.0041	0.0036	0.0050	0.0052	0.0045	0.0057	0.0010	NS	NS	NS
AMP	0.0066	0.0070	0.0070	0.0053	0.0055	0.0050	0.0011	NS	NS	NS
INO	0.2929	0.1534	0.2841	0.3012	0.2900	0.2350	0.0022	NS	NS	NS

(B)Breeds ; Duroc ; Landrace ; Yorkshire ; (S)Sexes ; Barrows ; Gilts.
NS: not significant, * $P < 0.05$, ** $P < 0.01$.
$^{a, b, c}$Values in the different breeds of the same sexes with different superscripts are significantly different ($P < 0.05$).
$^{x, y, z}$Values in the different sexes of the same breeds with different superscripts are significantly different ($P < 0.05$).

Table 16. Effects of pig's breeds and sexes on free amino acid content of the LD muscle(mg/g)

	Duroc		Landrace		Yorkshire			Significant		
	B	G	B	G	B	G	SEM	B	S	B×S
Phosphoserine	0.0114	0.0108	0.0138	0.0148	0.0132	0.0128	0.0011	NS	NS	BS
Serine	0.0303	0.0296	0.0298	0.0291	0.0287	0.0243	0.0023	NS	NS	NS
Threonine	0.0077^{a}	0.0068^{a}	0.0048^{bc}	0.0042^{b}	0.0057^{b}	0.0041^{b}	0.0011	*	NS	NS
Hisidine	0.0021^{c}	0.0028^{b}	0.0068^{a}	0.0062^{a}	0.0052^{b}	0.0068^{a}	0.0012	*	NS	NS
Taurine	0.0579^{a}	0.0559^{a}	0.0369^{b}	0.0349^{b}	0.0388^{b}	0.0347^{b}	0.0033	*	NS	NS
Glycine	0.0394	0.0378	0.0287	0.0292	0.0411	0.0388	0.0019	NS	NS	NS
Arginine	0.0068	0.0073	0.0072	0.0061	0.0079	0.0062	0.0013	NS	NS	NS
Anserine	0.6897	0.6785	0.6972	0.6811	0.6866	0.6714	0.0052	NS	NS	NS
Valine	0.0339	0.0441	0.0462	0.0447	0.0511	0.0536	0.0023	NS	NS	NS
Methonine	0.0047	0.0052	0.0041	0.0051	0.0044	0.0047	0.0023	NS	NS	NS
Isoleucine	0.0063	0.0071	0.0061	0.0067	0.0078	0.0082	0.0014	NS	NS	NS
Leuine	0.0067^{b}	0.0084^{b}	0.0127^{a}	0.0132^{a}	0.0078^{b}	0.0075^{b}	0.0025	*	NS	NS
Tryptophan	0.0678	0.0712	0.0662	0.0679	0.0787	0.0741	0.0014	NS	NS	NS
Phenylalanine	0.0228	0.0224	0.0211	0.0242	0.0239	0.0258	0.0023	NS	NS	NS
Lysine	0.0382	0.0278	0.0477	0.0322	0.0398	0.0369	0.0014	NS	NS	NS
Tyrosine	0.0078	0.0067	0.0069	0.0061	0.0081	0.0078	0.0025	NS	NS	NS
Carnosine	2.4501	2.5520	2.341	2.445	2.521	2.347	0.0123	NS	NS	NS
Glutamic Acid	0.0178	0.0185	0.0142	0.0157	0.0141	0.0149	0.0012	NS	NS	NS
Aspartic Acid	0.0161	0.0154	0.0137	0.0124	0.0140	0.0137	0.0012	NS	NS	NS

(B)Breeds ; Duroc ; Landrace ; Yorkshire ; (S)Sexes ; Barrows ; Gilts.

NS: not significant, * $P < 0.05$, ** $P < 0.01$.

[a, b, c]Values in the different breeds of the same sexes with different superscripts are significantly different ($P < 0.05$).

[x, y, z]Values in the different sexes of the same breeds with different superscripts are significantly different ($P < 0.05$).

Table 17. Effects of pig's breeds and sexes on fatty acid analysis of the LD muscle(%)

	Duroc	Landrace	Yorkshire				Significant		
	B							S	B×S
C12:0	4.11						S	NS	NS
C14:0	1.34						S	NS	NS
C16:0	23.78						S	NS	NS
C16:1	1.0212	1.0243	1.0083	1.0098	1.0052	1.0014	0.023	NS	NS	NS
C18:0	13.3869^{b}	13.5154^{b}	12.7425^{c}	13.0051^{b}	17.8987^{a}	15.0475^{a}	0.036	*	NS	NS
C18:1	35.1152^{a,y}	36.7896^{a,x}	35.7895^{a,y}	36.7158^{a,x}	32.4582^{b,y}	34.4258^{b,x}	0.059	*	*	NS
C18:2	17.5128^{a,x}	15.3651^{c,y}	15.7845^{b,y}	17.5428^{a,x}	17.4215^{a,x}	16.7895^{b,y}	0.067	*	*	*
C18:3	0.8792	1.0569	1.0082	0.7589	0.7282	0.8795	0.012	NS	NS	NS
C20:1	0.7201	0.7749	0.7785	0.6954	0.7245	0.8546	0.023	NS	NS	NS
C20:4	0.2541	0.2214	0.2125	0.1933	0.2321	0.2186	0.009	NS	NS	NS
SFA	42.6361^{b,x}	42.5823^{b,x}	42.4649^{b,x}	42.0044^{b,x}	46.1186^{a,x}	43.5246^{a,y}	0.036	*	*	NS
MUFA	36.8565^{a,y}	38.5888^{a,x}	37.5763^{a,y}	38.421^{a,x}	34.1879^{b,y}	36.2818^{b,x}	0.056	*	*	NS
PUFA	18.6461^{x}	16.6434^{y}	17.0052^{y}	18.495^{x}	18.3818^{x}	17.8876^{y}	0.023	NS	*	*

C18:1 & MUFA:Barrows < Gilts
SFA:Barrows > Gilts
C18:2 & PUFA:Breed and Sex interaction

(B)Breeds ; Duroc ; Landrace ; Yorkshire ; (S)Sexes ; Barrows ; Gilts.
NS: not significant, * $P < 0.05$, ** $P < 0.01$.
$^{a, b, c}$Values in the different breeds of the same sexes with different superscripts are significantly different ($P < 0.05$).
$^{x, y, z}$Values in the different sexes of the same breeds with different superscripts are significantly different ($P < 0.05$).

Table 18. Effects of pig's breeds and sexes on melting points of the LD muscle(℃)

	Duroc		Landrace		Yorkshire			Significant		
	B	G	B	G	B	G	SEM	B	S	B×S
初始熔點 Initial melting point	$29.78^{b,x}$	$28.74^{b,y}$	$28.74^{c,x}$	$29.01^{b,x}$	$31.25^{a,x}$	$30.17^{a,y}$	0.23	*	*	NS
終端熔點 Fully melting point	$44.78^{a,x}$	$43.12^{a,y}$	$41.15^{b,x}$	$40.99^{b,x}$	$45.42^{a,x}$	$43.78^{a,y}$	0.41	*	*	NS

(B)Breeds ; Duroc ; Landrace ; Yorkshire ; (S)Sexes ; Barrows ; Gilts.
NS: not significant, * $P < 0.05$, ** $P < 0.01$.
$^{a, b, c}$Values in the different breeds of the same sexes with different superscripts are significantly different ($P < 0.05$).
$^{x, y, z}$Values in the different sexes of the same breeds with different superscripts are significantly different ($P < 0.05$).

Table 19. Effects of pig's breeds and sexes on sensory evaluation of the LD muscle

Tenderness
Juiceness
Flavor
Overall acceptability

Barrows > Gilts

	Duroc		Landrace		Yorkshire			Significant		
	Barrows	Gilts	Barrows	Gilts	Barrows	Gilts	EM	B	S	B*S
顏色 Color	4.728	3.998	4.125	4.336	4.541	3.779	0.12	NS	NS	NS
氣味 Odor	5.899	5.664	5.785	5.772	5.693	5.502	0.11	NS	NS	NS
嫩度 Tenderness	$6.996^{a,x}$	$6.421^{a,y}$	$5.728^{b,x}$	$5.441^{b,y}$	$5.014^{c,x}$	$4.998^{c,x}$	0.23	*	*	NS
多汁性 Juiceness	$6.114^{a,x}$	$5.219^{a,y}$	$5.787^{b,x}$	$5.449^{a,y}$	$4.212^{c,x}$	$4.119^{c,y}$	0.17	*	*	NS
甘味 Sweetness	3.728^{a}	3.772^{a}	2.118^{b}	2.582^{b}	2.018^{b}	2.116^{c}	0.22	*	NS	NS
風味 Flavor	$6.125^{a,x}$	$5.889^{b,y}$	$6.112^{a,x}$	$6.018^{a,x}$	$5.779^{b,x}$	$5.861^{b,x}$	0.17	*	*	NS
總接受度 Overall acceptability	$6.621^{a,x}$	$6.264^{a,y}$	$5.891^{b,x}$	$5.776^{b,x}$	$5.064^{c,x}$	$5.007^{c,x}$	0.11	*	*	NS

(B)Breeds ; Duroc ; Landrace ; Yorkshire ; (S)Sexes ; Barrows ; Gilts.
NS: not significant, * $P < 0.05$, ** $P < 0.01$.
$^{a, b, c}$Values in the different breeds of the same sexes with different superscripts are significantly different ($P < 0.05$).
$^{x, y, z}$Values in the different sexes of the same breeds with different superscripts are significantly different ($P < 0.05$).

Correlation of meat quality and sensory evaluation of LD muscle I

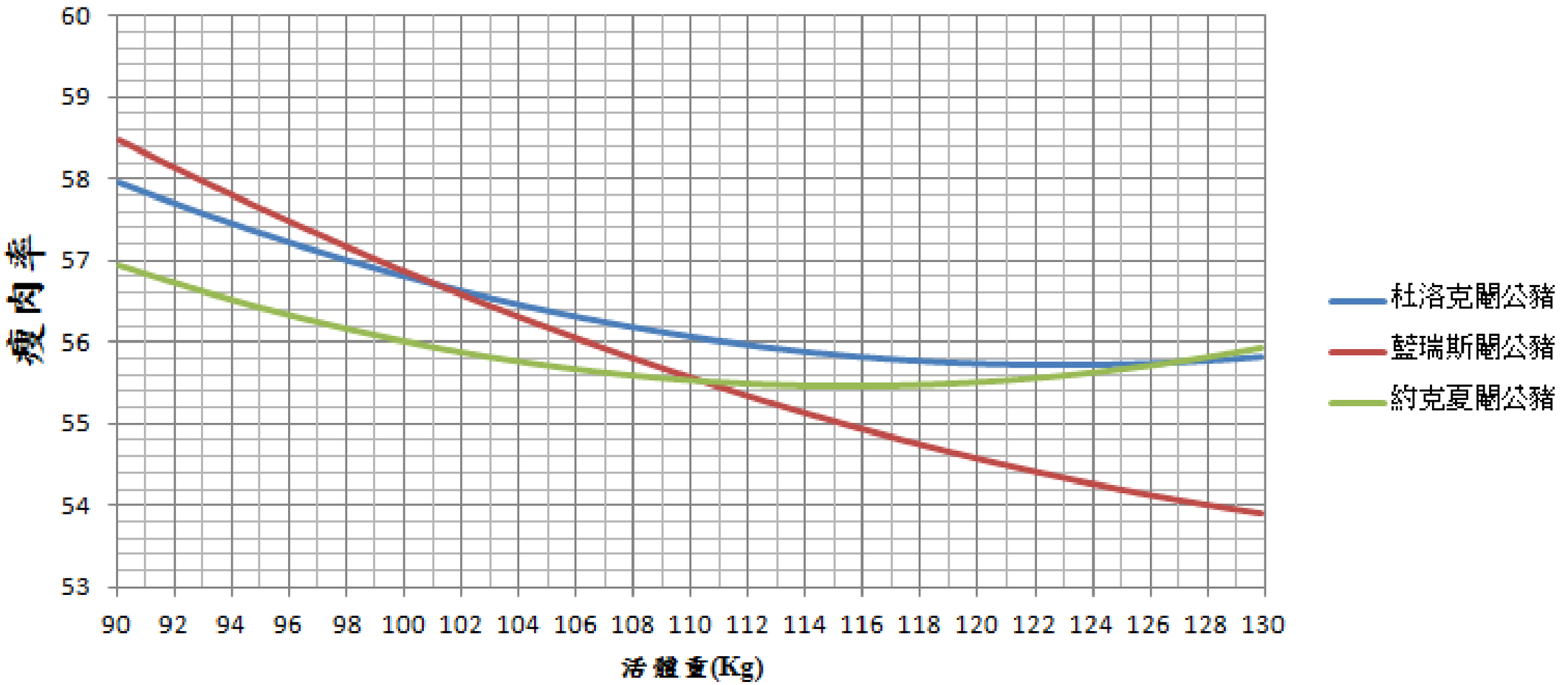
	Crude fat	Marbling	SFA	MUFA	PUFA	Shear value	Hardness	Tenderness	Juiciness	Sweetness	Flavor
Crude fat											
Marbling	0.69*										
SFA	-0.39*	-0.61*									
MUFA	0.64*	0.58*	-0.47*								
PUFA	0.17	0.26	-0.52*	-0.36*							
Shear value	-0.52*	-0.48*	0.11	-0.44*	0.21						
Hardness	-0.47*	-0.39*	0.09	-0.41*	0.19	0.97*					
Tenderness	0.59*	0.44*	-0.43*	0.42*	0.17	-0.72*	-0.66*				
Juiciness	0.64*	0.59*	-0.52*	0.55*	0.23	-0.45*	-0.39*	0.55*			
Sweetness	0.44*	0.47*	0.17	0.09	-0.11	-0.39*	-0.42*	0.23	0.29		
Flavor	0.35*	0.43*	0.12	0.33*	-0.33*	-0.39*	-0.36*	0.66*	0.59*	0.34*	
Overall acceptability	0.37*	0.33*	0.17	0.43*	0.22	-0.68*	-0.55*	0.72*	0.68*	0.51*	0.47*

* $P < 0.05$

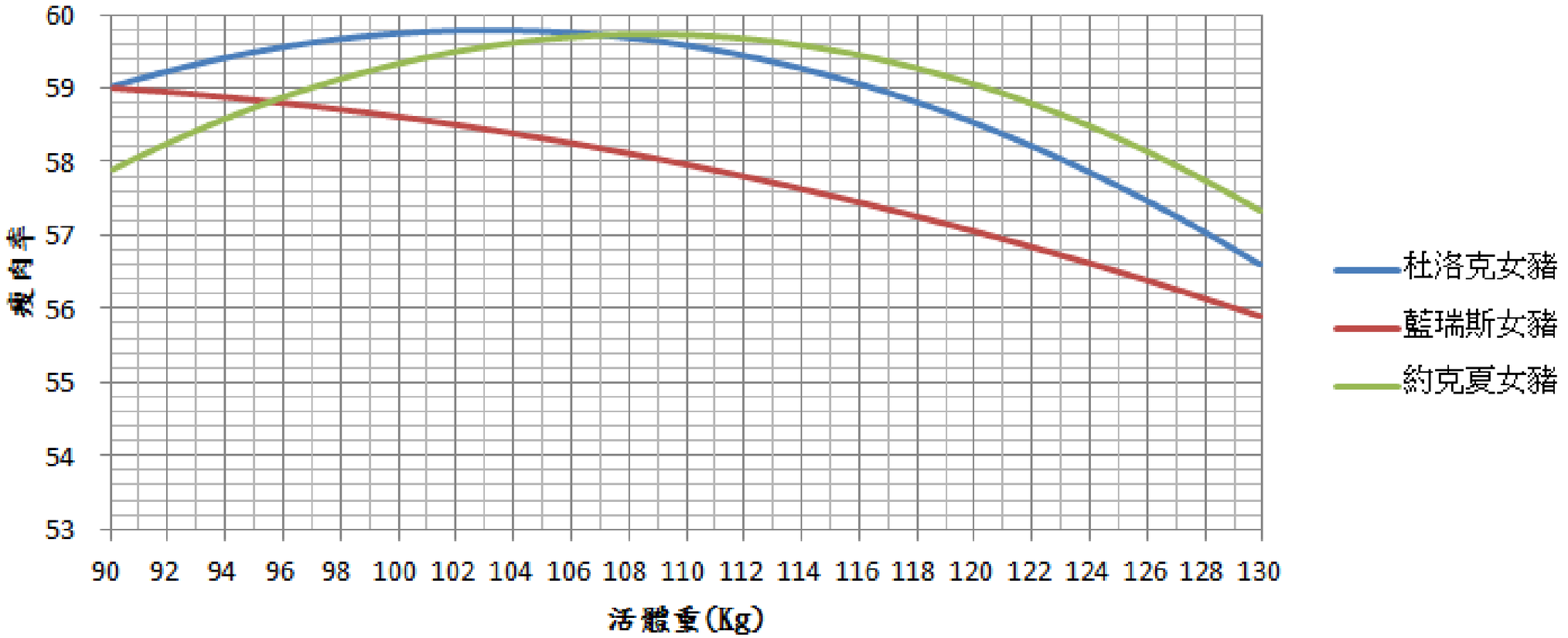
Correlation of meat quality and sensory evaluation of LD muscle II

	GMP	IMP	Hx	Thre	Serine	Glu	Asp	Tenderness	Juiciness	Sweetness	Flavor
GMP											
IMP	0.23										
Hx	-0.33*	-0.41*									
Thre	0.21	0.27	-0.11								
Serine	0.17	0.23	0.17	0.37*							
Glu	0.29	0.21	-0.21	0.42*	0.44*						
Asp	0.21	0.19	0.09	0.45*	0.37*	0.55*					
Tenderness	0.33*	0.37*	-0.27	0.27	0.11	0.17	0.18				
Juiciness	0.36*	0.39*	-0.18	0.29	0.27	0.32	0.21	0.47*			
Sweetness	0.47*	0.52*	-0.36*	0.36*	0.39*	0.42*	0.39*	0.39*	0.41*		
Flavor	0.45*	0.47*	-0.21	0.42*	0.21	0.43*	0.42*	0.33*	0.52*	0.33*	
Total acceptability	0.31	0.39*	-0.43*	0.21	0.23	0.26	0.24	0.57*	0.35*	0.21	0.36*

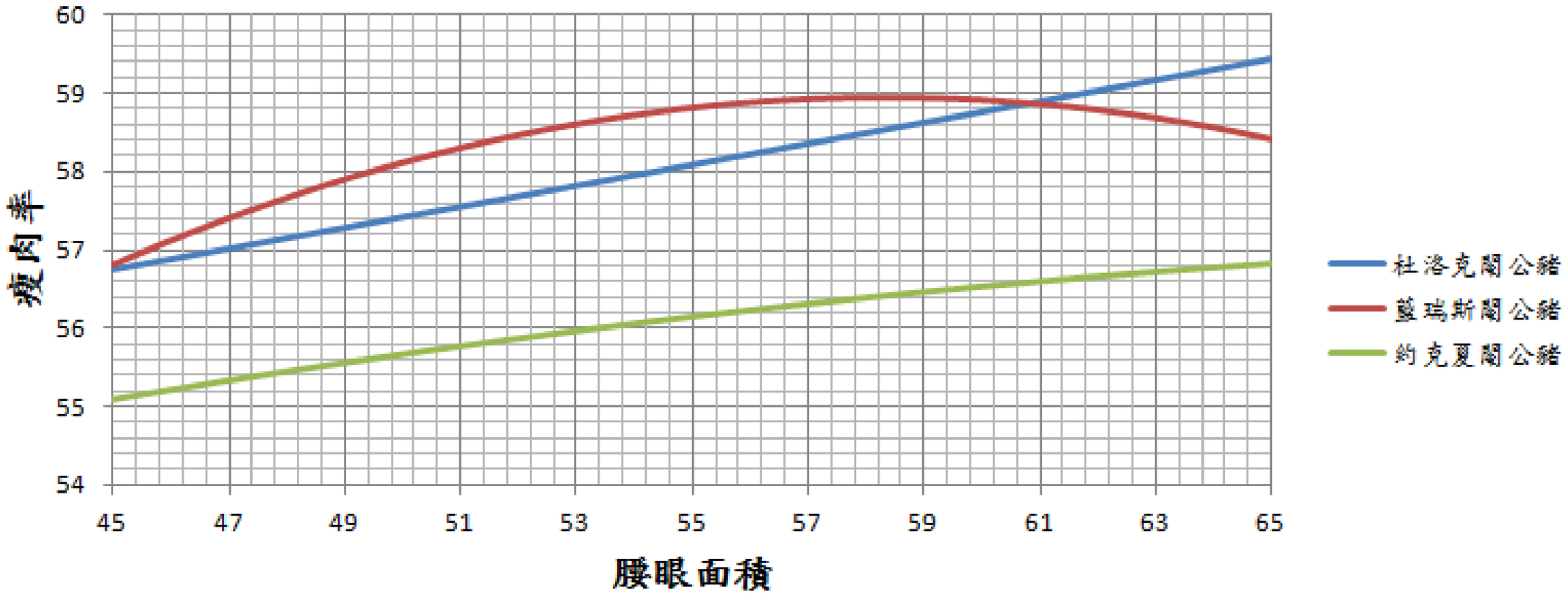
* $P < 0.05$



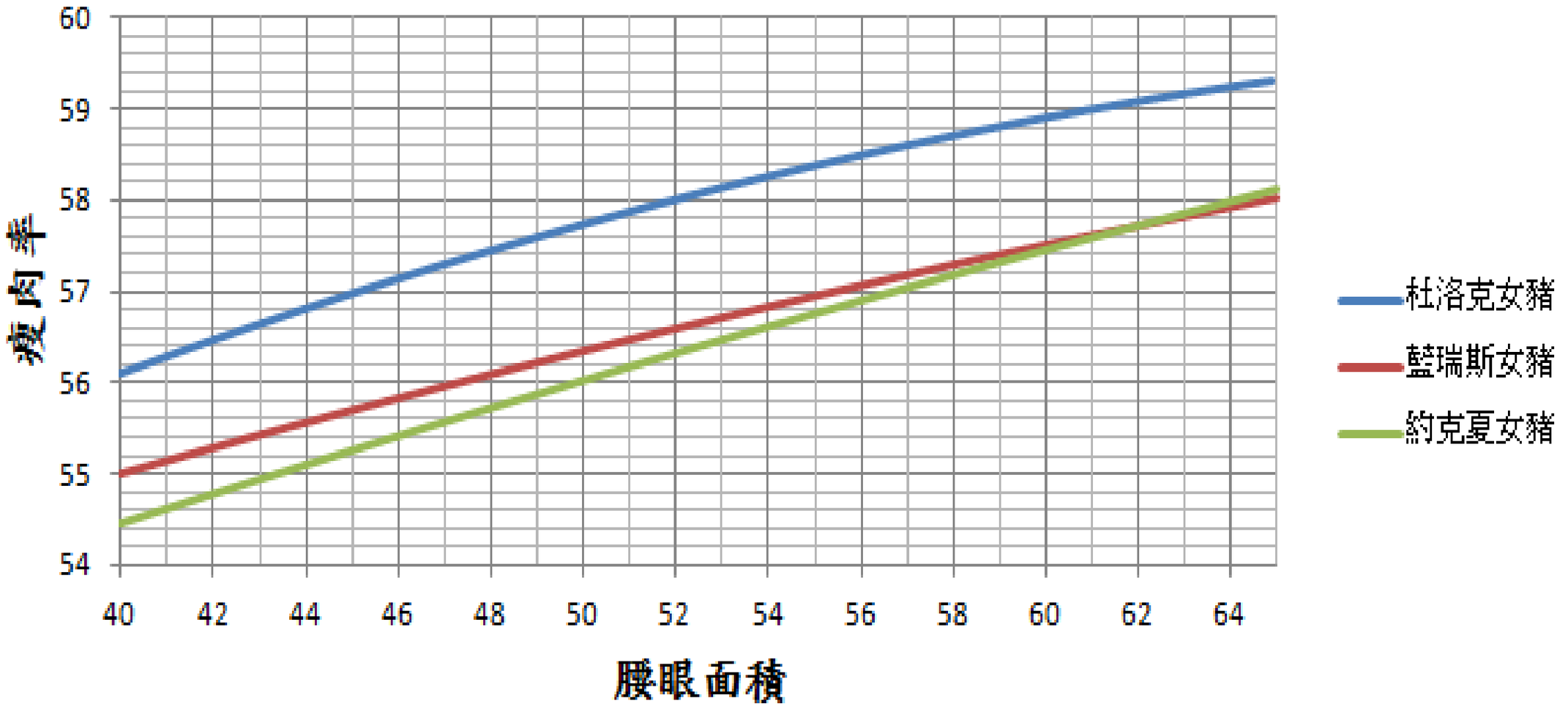
- Fig. 3. Quadratic regression prediction on body weight and lean percentage of barrows from different breeds.



- Fig. 4. Quadratic regression prediction on body weight and lean percentage of gilts from different breeds.



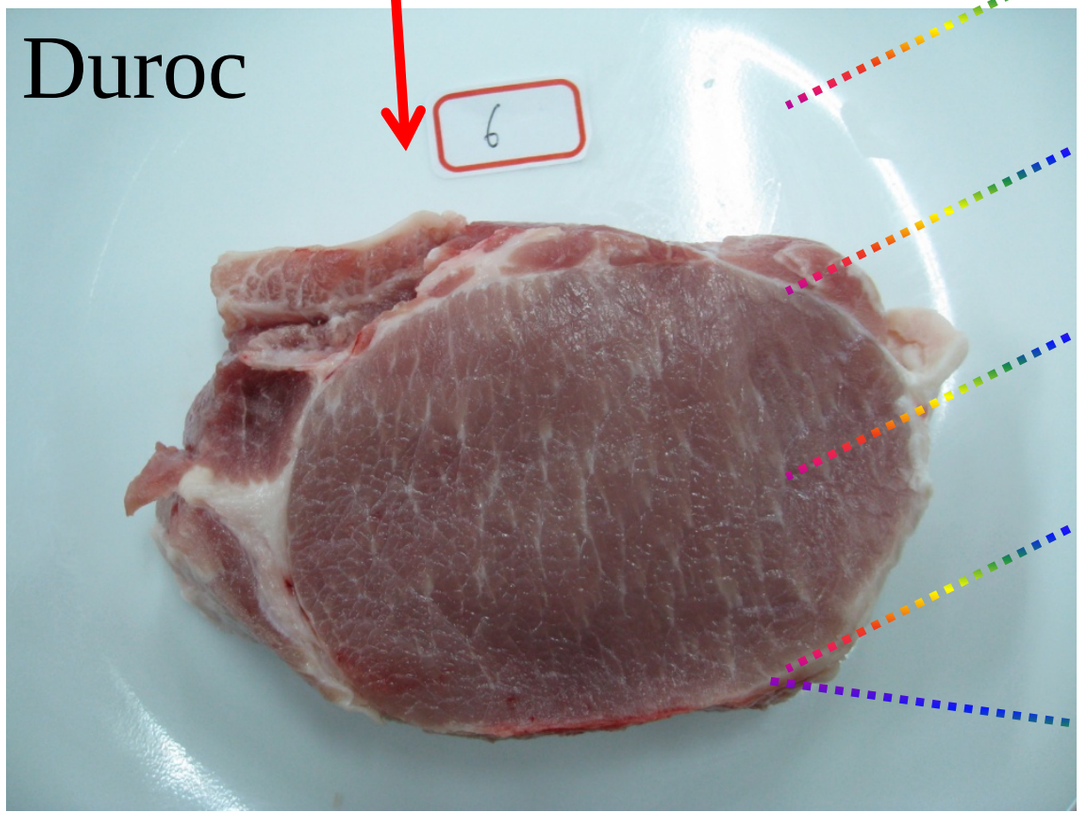
- Fig. 5. Quadratic regression prediction on loineye area and lean percentage of barrows from different breeds.



- Fig. 6. Quadratic regression prediction on loineye area and lean percentage of gilts from different breeds.

- 小結

Red & Marbling & Frimness



pH1 & pH24 & WHC

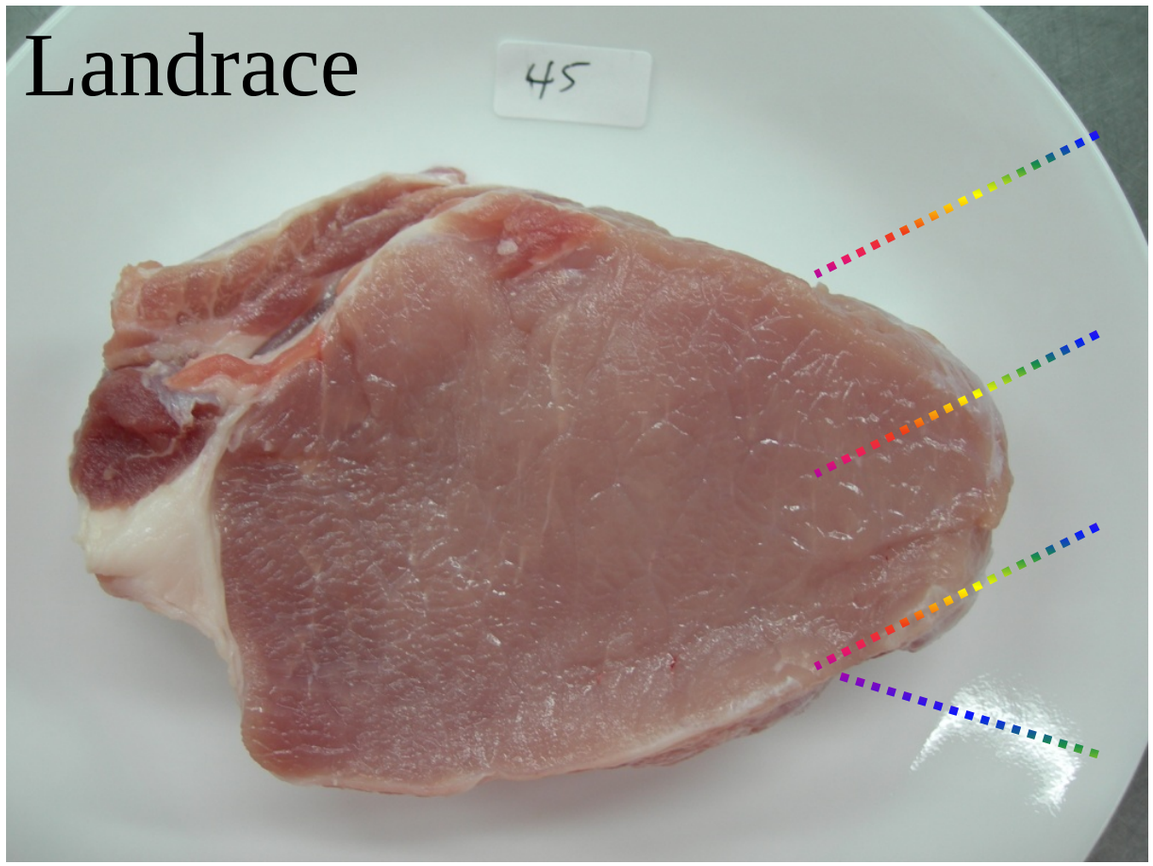
Cooking loss

Fat content

Shear value & Hardness

IMP & Threonine & Taurine

✓Tenderness
✓Juiciness
✓Sweetness
✓Flavor
✓Overall acceptability



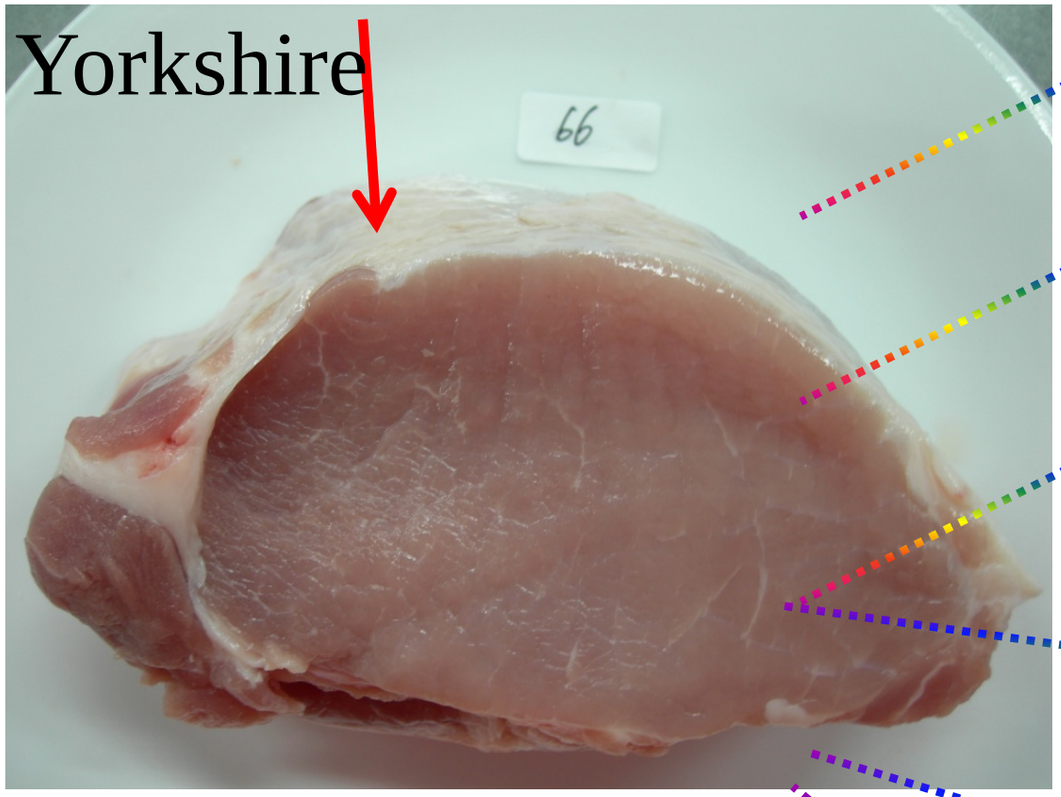
Hisidine ↑

Leucine ↑

Fat content ↓

C18:1 ↑

Pale & Soft & Exudative



pH1 & pH24 & WHC ↓

Cooking loss ↑

Shear value & Hardness ↑

IMP ↓

C18:0 ↑

Melting point ↑

- ✓Tenderness
- ✓Juiciness
- ✓Sweetness
- ✓Flavor
- ✓Overall acceptability

Protein
WHC
a value
Shear value & Hardness
C18:1 & MUFA

Barrows < **Gilts**

Fat
b value
Shear value & Hardness
SFA & Melting point
Tenderness
Juiciness
Sweetness
Flavor
Overall acceptability

Barrows > **Gilts**

Step1

- 藉由了解豬隻品種與性別特性進而探討台灣三品種雜交豬的屠體與肉質性狀，以建立豬隻屠體資料庫提供產官學界之參考。

Step2

- 如何給予飼養戶適當的活體重建議，以獲得較佳的豬隻屠體性能，提升飼養戶與加工業者於經濟獲利效益上的雙贏

Step3

- 以特色化經營飼養，提高產品附加價值

a, b, c (Mean±SE) Values in the same row with different superscripts are significantly different ($P < 0.05$).

Thanks for your attention!