

種豬緊迫與多產基因應用

Porcine Stress Gene and Prolific Gene

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畜產試驗所遺傳育種組

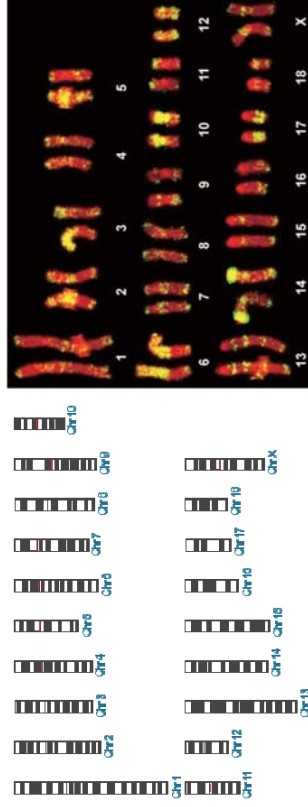
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大綱

- 豬遺傳背景 Genetic background
- 緊迫基因檢測技術 PSS identification
- 多產基因檢測技術 ESR identification
- 結論 Q&A

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豬染色體



www.animalgenome.org

Federico *et al.*, 2004

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豬基因體研究現況

Swine genome study

Assembly:	Ssrofa10.2, Aug 2011
Database version:	79.102
Base Pairs (鹼基配對)	3,024,658,544
Golden Path Length:	2,808,525,991
Genebuild by:	Ensembl
Genebuild method:	Full genebuild
Genebuild started:	Sep 2011
Genebuild released:	May 2012
Genebuild last updated/patched:	Feb 2014
Coding genes: (蛋白質編碼基因)	21,630
Non coding genes:	3,124
Pseudogenes:	568
Gene transcripts:	30,585

www.ensembl.org/Sus_scrofa/Location/Genome

豬經濟性狀基因座資料庫 (Pig QTLdb)

- 12,618個數量性狀基因座 (QTLs)
- 656種不同性狀 (肉與屠體品質、健康、外表、產量、繁殖)

染色體	QTL	染色體	QTL	染色體	QTL
1	1933	8	714	15	500
2	1563	9	571	16	278
3	408	10	255	17	249
4	951	11	222	18	243
5	511	12	457	X	378
6	1199	13	529	Y	1
7	1451	14	611		

www.animalgenome.org/cgi-bin/QTLdb/SS/index

Pioneers in swine genome project



Lawrence B. Schook
business.illinois.edu



Max F. Rothschild
www.ans.iastate.edu/faculty/

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緊迫基因PSS

蒼白軟性水樣肉

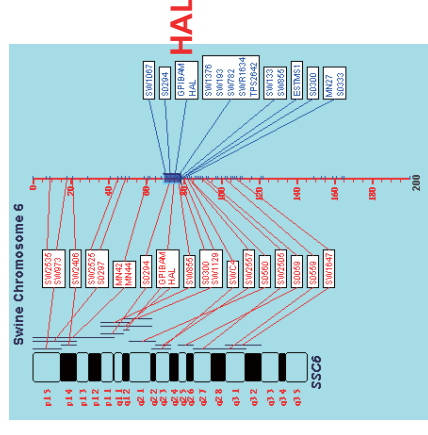


鹵乙烷檢測



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豬第6號染色體



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<http://www.marc.usda.gov/genome/htmls/LinkageMap.jsp>

檢測流程Workflow

Samples

- 血液、精液、組織
- DNA萃取
- MS-PCR
- 電泳分離
- 染色成像



參考方法



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Use of Mutagenically Separated PCR for the Detection of the Mutation Associated with Porcine Stress Syndrome

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(Received 14 November 1995; revised version received 10 January 1996; accepted 12 January 1996)

ABSTRACT

A point mutation in the *RyR1* gene encoding the ryanodine receptor in porcine skeletal muscle is associated with enhanced growth characteristics and leaness but also with porcine stress syndrome (PSS). The mutation was detected by a mutagenically separated PCR (MS-PCR) method. The mutation is based on the polymerase chain reaction (PCR), followed by separation of the PCR products on agarose gels. Using a technique known as mutagenically separated PCR (MS-PCR), a one-step procedure for the identification of the point mutation associated with porcine stress syndrome has been developed. This removes the requirement of the current PCR-based test for restriction enzyme digestion, is consequently quicker to perform and does not require the use of restriction enzymes. The results of the MS-PCR and complete agreement between the two methods was obtained. Copyright © 1996 Elsevier Science Ltd

緊迫基因 PSS

出生年	品種數	場數	緊迫基因檢測				
			總頭數	BB	AB	AA	AA(%)
2014	10	18	1540	1	67	1472	95.6
2013	13	25	3013	2	85	2926	97.1
2012	12	33	3865	6	141	3718	96.2
2011	14	36	3845	4	208	3633	94.5
2010	12	39	3867	7	244	3616	93.5
2009	12	33	3404	10	240	3154	92.7
2008	8	31	2717	16	290	2411	88.7
2007	6	30	2973	8	332	2633	88.6
2006	6	27	3017	22	474	2521	83.6
2005	5	25	3272	44	617	2611	79.8
合計			31513	120	2698	28695	91.0

藍瑞斯 Landrace

出生年	場數	緊迫基因檢測				
		總頭數	BB	AB	AA	AA(%)
2014	12	516	0	0	516	100.0
2013	17	986	0	3	983	99.7
2012	22	1079	1	6	1072	99.4
2011	22	1090	0	12	1078	98.9
2010	24	1264	0	23	1241	98.2
2009	21	1106	2	36	1068	96.6
2008	20	880	4	60	816	92.7
2007	23	987	0	21	966	97.9
2006	21	774	0	15	759	98.1
2005	21	853	1	16	836	98.0
合計		9535	8	192	9335	98.0

約克夏 Yorkshire

出生年	場數	緊迫基因檢測				AA(%)
		總頭數	BB	AB	AA	
2014	9	149	0	2	147	98.7
2013	10	257	0	4	253	98.4
2012	14	330	0	3	327	99.1
2011	18	450	0	5	445	98.9
2010	15	418	0	3	415	99.3
2009	19	379	0	2	377	99.5
2008	16	334	0	2	332	99.4
2007	13	256	0	1	255	99.6
2006	14	204	0	9	195	95.6
2005	16	208	0	1	207	99.5
合計 ¹⁴		2985	0	32	2953	98.8

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

ESR多產基因標記

- ESR遺傳標記與豬隻繁殖性能有關。
- 具「多產基因純合型」的母豬，其第一胎產仔數平均每窩可多生**0.39**頭活仔豬，爾後胎次平均每窩亦可多生**0.31**頭。
- 開發與應用MS-PCR檢測法，進行早期選種計畫，不僅可減少所需更新候補種豬的飼養頭數，且可降低單位產能之生產成本，提升產業的競爭力。

杜洛克 Duroc

出生年	場數	緊迫基因檢測				AA(%)
		總頭數	BB	AB	AA	
2014	15	639	1	46	592	92.6
2013	23	1356	2	64	1290	95.1
2012	25	1741	5	125	1611	92.5
2011	25	1860	4	167	1689	90.8
2010	29	2016	7	205	1804	89.5
2009	27	1797	8	197	1592	88.6
2008	28	1437	10	225	1202	83.6
2007	25	1713	8	310	1395	81.4
2006	23	2020	22	449	1549	76.7
2005	23	2184	43	598	1543	70.7
合計 ¹⁴		16763	110	2386	14267	86.2

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

參考資料

Effect of the Estrogen Receptor Locus on Reproduction and Production Traits in Four Commercial Pig Lines¹

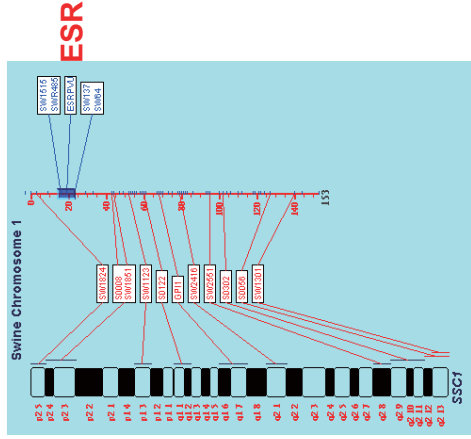
T. H. Short¹, M. F. Rothschild², O. I. Southwood³, D. G. McLaren⁴, A. de Vries⁵, H. van der Steer⁶, G. R. Eckardt⁷, C. K. Tuggle⁸, J. Helm⁹, D. A. Vaske¹⁰, A. J. Miteham¹¹, and G. S. Plastow¹²

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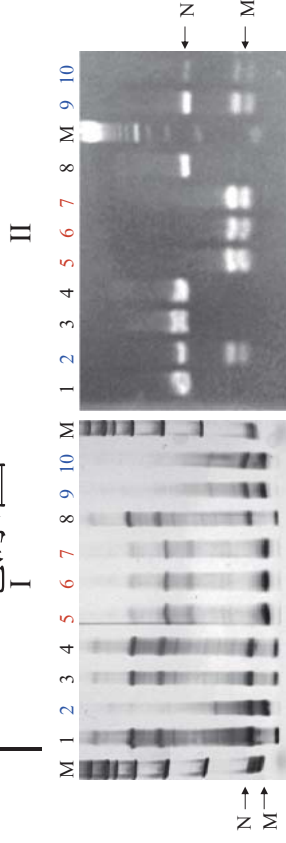
ABSTRACT: We investigated the effect of the estrogen receptor (ESR) gene on growth and reproductive traits in four Large White-based commercial pig lines. A total of 5,015 litter records from 4,262 sows genotyped at the ESR locus were analyzed to assess whether ESR influenced total number born (TNB), test ADG, ADFI, feed:gain ratio (F/G) and ultrasonic backfat (BF). The TNB and NBA were also analyzed to date. Average TNB was 13.1 for pigs carrying the favorable allele vs 13.2 for noncarriers ($P < .05$). Mean ADFI was 1.75 for pigs carrying the favorable allele vs 1.74 for noncarriers ($P < .05$). Mean F/G was 0.16 for pigs carrying the favorable allele vs 0.16 for noncarriers ($P < .05$). Mean BF was 1.75 for pigs carrying the favorable allele vs 1.74 for noncarriers ($P < .05$). Mean ADFI was 1.75 for pigs carrying the favorable allele vs 1.74 for noncarriers ($P < .05$). Mean F/G was 0.16 for pigs carrying the favorable allele vs 0.16 for noncarriers ($P < .05$). Mean BF was 1.75 for pigs carrying the favorable allele vs 1.74 for noncarriers ($P < .05$). Mean ADFI was 1.75 for pigs carrying the favorable allele vs 1.74 for noncarriers ($P < .05$). Mean F/G was 0.16 for pigs carrying the favorable allele vs 0.16 for noncarriers ($P < .05$). Mean BF was 1.75 for pigs carrying the favorable allele vs 1.74 for noncarriers ($P < .05$).

Key Words: Estrogen Receptors, Reproduction, Growth, Genetic Markers, Major Genes, Phototropy

豬第1號染色體



ESR電泳圖



豬 ESR 基因型檢測
 Panel I: MS-PCR
 NN : 1、3、4、8
 MN : 2、9、10
 MM : 5、6、7
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多產基因 ESR

出生年	品種數	場數	多產基因檢測						M-	M-(%)
			總頭數	NN	MN	MM	MM(%)	M-		
2014	10	18	1481	1164	198	119	8.0	436	14.7	
2013	13	25	2948	2338	363	247	8.4	857	14.5	
2012	12	33	3751	2899	499	353	9.4	1205	16.1	
2011	14	36	3706	2997	413	296	8.0	1005	13.6	
2010	12	38	3833	3274	386	173	4.5	732	9.5	
2009	12	32	3222	2779	300	143	4.4	586	9.1	
2008	8	31	2640	2274	247	119	4.5	485	9.2	
2007	6	27	2275	2022	176	77	3.4	330	7.3	
2006	6	25	2274	2147	87	40	1.8	167	3.7	
2005	5	23	2538	2397	99	42	1.7	183	3.6	
合計	19		28668	24291	2768	1609	5.4	5986	10.1	

藍瑞斯 Landrace

出生年	場數	多產基因檢測						M-	M-(%)
		總頭數	NN	MN	MM	MM(%)	M-		
2014	12	516	437	63	16	3.1	95	9.2	
2013	17	985	841	114	30	3.0	174	8.8	
2012	22	1072	912	149	11	1.0	171	8.0	
2011	22	1078	957	119	2	0.2	123	5.7	
2010	24	1242	1057	172	13	1.0	198	8.0	
2009	21	1036	920	110	6	0.6	122	5.9	
2008	20	816	747	69	0	0.0	69	4.2	
2007	20	716	647	68	1	0.1	70	4.9	
2006	17	543	515	26	2	0.4	30	2.8	
2005	20	605	573	29	3	0.5	35	2.9	
合計	20	8609	7606	919	84	1.0	1087	6.0	

約克夏 Yorkshire

出生年	場數	多產基因檢測									
		總頭數	NN	MN	MM	MM(%)	M-	M-(%)			
2014	9	149	13	81	55	36.9	191	64.1			
2013	10	255	37	114	104	40.8	322	63.1			
2012	14	328	66	146	116	35.4	378	57.6			
2011	18	446	115	190	141	31.6	472	52.9			
2010	15	416	97	184	135	32.5	454	54.6			
2009	19	362	93	157	112	30.9	381	52.6			
2008	16	332	68	170	94	28.3	358	53.9			
2007	12	213	44	106	63	29.6	232	54.5			
2006	12	134	44	60	30	22.4	120	44.8			
2005	13	149	47	65	37	24.8	139	46.6			
合計	21	2784	624	1273	887	31.3	3047	54.5			

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

杜洛克 Duroc

出生年	場數	多產基因檢測									
		總頭數	NN	MN	MM	MM(%)	M-	M-(%)			
2014	15	598	593	5	0	0.0	5	0.4			
2013	23	1303	1302	1	0	0.0	1	0.0			
2012	25	1637	1637	0	0	0.0	0	0.0			
2011	25	1746	1745	1	0	0.0	1	0.0			
2010	28	2006	2006	0	0	0.0	0	0.0			
2009	26	1702	1697	3	2	0.1	7	0.2			
2008	28	1428	1427	1	0	0.0	1	0.0			
2007	23	1329	1328	1	0	0.0	1	0.0			
2006	23	1578	1576	1	1	0.1	3	0.1			
2005	22	1757	1752	5	0	0.0	5	0.1			
合計	22	15084	15063	18	3	0.02	24	0.08			

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

結論

- 利用先進之分子檢測技術(molecular biotechnology)可有效地提升種豬(breeding pig)之選育(selection)成效。
- 種豬之基因檢測與選育，需政府機構(government)與民間業者(farmer)之相互合作(cooperation)，始克其功。

TAF認證實驗室





謝謝聆聽

敬請指教Q&A