

Utilization of DNA marker Selection in Breeder and Commercial Farms

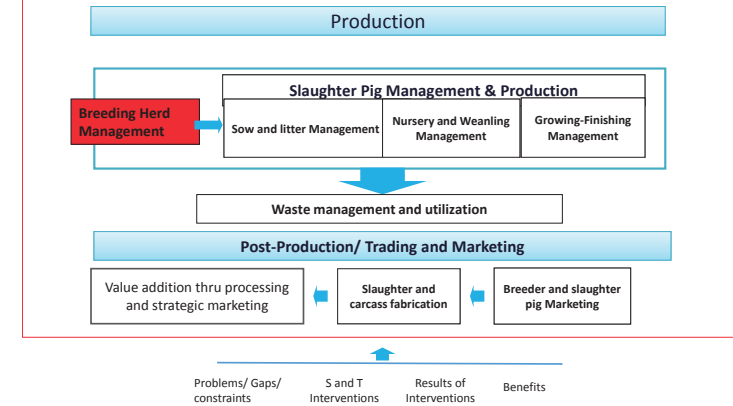
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Rationale

Outcome: PWSY from 19 to 22 pigs, Pre-weaning Mortality from 10 to 5%, ADG from 545 to 600 grams, FCR from 3 to 2.5



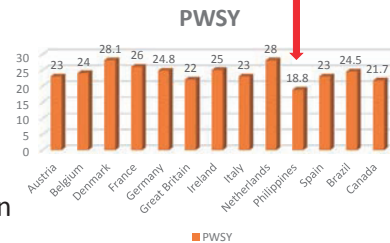
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Philippine Swine Industry

- 2nd Contributor to Economic activity in agricultural sector
- 12.43 million heads
- Php 206 billion total value of agricultural production

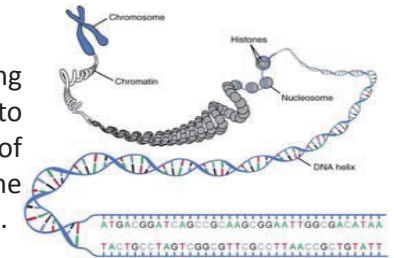


- Ranked 8th in Sow Population next to Canada and Vietnam



DNA MARKER TECHNOLOGY

Marker-Assisted-Selection (MAS) is the process of using DNA evaluation results to assist in the selection of individuals that would be the parents of the next generation.

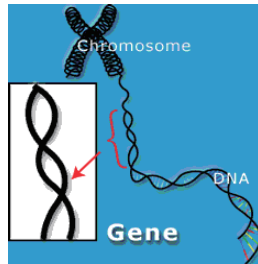


- ✓ Promote the adoption of molecular methods of selection by local swine raisers to improve prolificacy and production efficiency thru the establishment of a private-sector operated swine genomics service laboratory



Previously...

7 gene markers for screening of genetic defects and disease resistance:
PSS, RN, BAX, MX1, FUT1, BPI, NRAMP1



10 gene markers for screening of fertility, growth and meat quality traits:
ESR, PRLR, LIF, RBP4, MYOG, MC4R, HFABP, CAST, LEPR, IGF2

GENE MARKERS

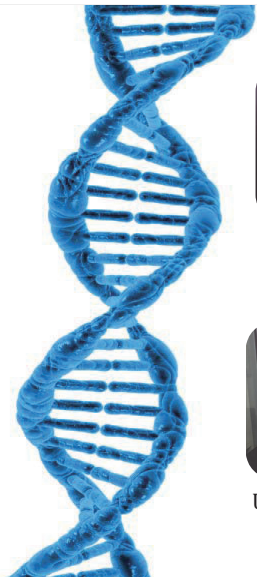
A. Fertility traits

Gene	Associated with
Estrogen receptor (ESR), Prolactin receptor (PRLR), Leukocyte Inhibitory Factor (LIF)	Litter size
Retinol binding protein 4(RBP4)	Litter size, Sperm quality

B. Growth and meat quality traits

Gene	Associated with
Myogenin (MYOG)	Average Daily Gain and muscle mass
Heart-fatty acid binding protein (HFABP)	Intramuscular fat (IMF)
Insulin-like growth factor 2 (IGF2)	Leanness
Leptin receptor (LEPR), Melanocortin-4 receptor (MC4R)	Body composition and fat

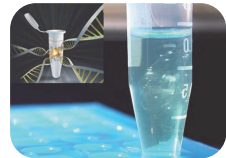
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METHODOLOGY



Blood Collection



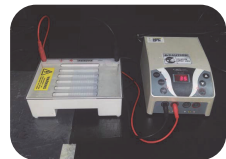
DNA Extraction



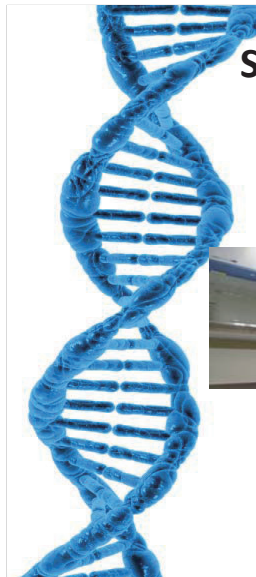
PCR Amplification



UV Transillumination



Gel Electrophoresis



Swine Genetic Analytical Service Laboratory



Results

Genotype and allele frequency affecting fertility traits that were tested.

GENE	GENOTYPE						ALLELE	
	AA		AB		BB		A	B
	N	Freq.	N	Freq.	N	Freq.	Freq.	Freq.
ESR	441	0.35	723	0.57	108	0.08	0.63	0.37
PRLR	78	0.12	262	0.39	323	0.49	0.32	0.68
LIF	173	0.20	455	0.53	228	0.27	0.47	0.53

Average marker effect for Estrogen Receptor gene On No. of piglets born alive

Parity No.	GENOTYPE						Overall Average	N
	AA		AB		BB			
	Mean	N	Mean	N	Mean	N		
1	10.6	9	12.4	19	11.7	15	11.7	43
2	9.7	9	10.9	19	11.2	15	10.6	43
3	12.6	9	12.2	14	13.5	10	12.7	33
4	12.2	5	11.4	8	10.2	6	11.2	19
5	12.3	3	10.7	7	9.8	5	10.7	15
6	13.5	2	9.3	3	13.8	5	12.4	10

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Average marker effect for Leukemia Inhibitory factor gene On farrowing interval

GENE	GENOTYPE					
	AA		AB		BB	
	Mean, dd	SE	Mean, dd	SE	Mean, dd	SE
ESR	158.2	3.4	156.7	3.8	154.2**	5.3
PRLR	160.5**	6.0	158.0	5.2	157.2	4.0
LIF	162.6	5.7	156.76	3.8	155.8**	4.9

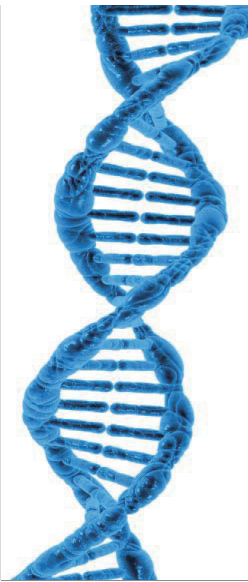
Genotypic and allelic frequency of genes for growth and meat quality

GENE	Distribution of genotypes (%)			Allele frequencies	
	AA	AB	BB	A	B
MYOG	99.2**	0.80	-	99.6	0.40
LEPR	16.93	38.69	44.37**	36.28	63.72
IGF2	44.56**	43.54	11.90	66.33	33.67
H-FABP GENE RFLP					
HaeIII	39.57	43.25	17.1**	61.20	38.80
MspI	3.06**	15.38	81.56	10.75	89.25
Hinfl	3.14	33.43	63.43	19.9	80.14



Genotypic frequency for *Hal*, *BAX* and *RN* gene in the pig population

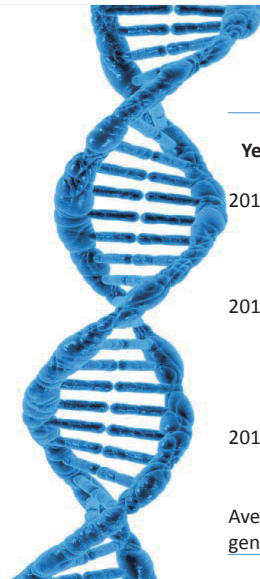
Gene	Genetic defect	No. of samples	Genotype Frequency		
			Normal	Carrier	Mutant
Hal	Porcine Stress Syndrome	1463	93.51	5.04	1.45
RN	Acid Meat	1457	91.07	5.33	3.61
BAX	Scrotal Hernia	1256	96.29	2.21	1.50



Genotypic frequency for the screening of disease resistance in the pig population

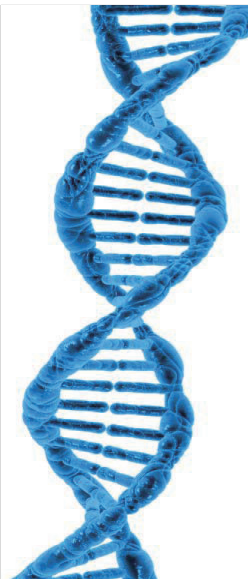
Gene	Associated with	No. of samples	Genotype Frequency		
			Resistant	Heterozygous	Susceptible
FUT1	Resistance to <i>E. coli</i> F18	1312	3.96	34.68*	61.36*
MX1	Resistance against influenza virus	1348	79.90	18.25	1.85
BPI	Resistance against Salmonella	1397	98.93	0.86	0.21
NRAMP1	Immune function and production performance	1251	43.25	48.92	7.83

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Average marker effect for *FUT1* gene on pre-weaning mortality

Year	Parity	GENOTYPE							
		AG				GG			
		N	No. Weaned	No. Mort.	% Mort.	N	No. Weaned	No. Mort.	% Mort.
2015	1	5	11.6	0.6	4.5	14	8.9	2.5	40.3
	2	5	10.8	0.6	4.5	14	10.6	1.4	15.0
	3	3	12.3	1.3	10.5	4	13.0	1.0	8.0
2016	1	7	10.4	1.7	19.3	16	10.6	0.9	9.9
	2	6	11.7	0.7	5.6	15	8.1	0.7	6.0
	3	2	12.0	0.0	0.0	14	10.2	1.3	13.6
	4	5	11.2	0.6	5.6	14	9.9	1.1	9.7
2017	2	1	12.0	0.0	0.00	1	3.0	0.0	0.0
	3	5	12.6	2.2	17.6	2	12.5	1.0	8.0
Average/genotype		39	11.5	1.0	9.2	94	9.8	1.3	14.9



Genotype and Haplotype frequencies of selected markers In a Native Pig herd

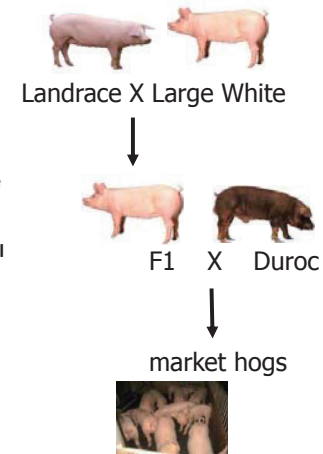
Haplotype group code	Marbling (HFABP) Freq (%)	ESR		FUT1	
		Genotype	Freq (%)	Genotype	Freq (%)
HL5	18.2	AA	86.4	AA	50.0
HL4	50.0	AB	13.6	AG	40.9
HL3	27.3			GG	9.1
LL2	4.5				

Seven codes defined for 27 combinations of three allelic mutation genotypes of H-FABP gene in pigs

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

Ming-Che Wu et al. Networking System for Marker-Assisted Selection in Pigs
H-FABP – hear fatty acid binding protein

APPLICATION



All breeder animals are PSS-free and BAX-free (scrotal hernia)

Sowline should carry the favorable genotype of ESR/LIF/PRLR (litter size)

Boarline should carry the favorable genotype of HFABP (marbling), IGF2 (leanness); resistance to E. coli (FUT1) and influenza virus (MX1)

ACKNOWLEDGEMENT



THANK YOU