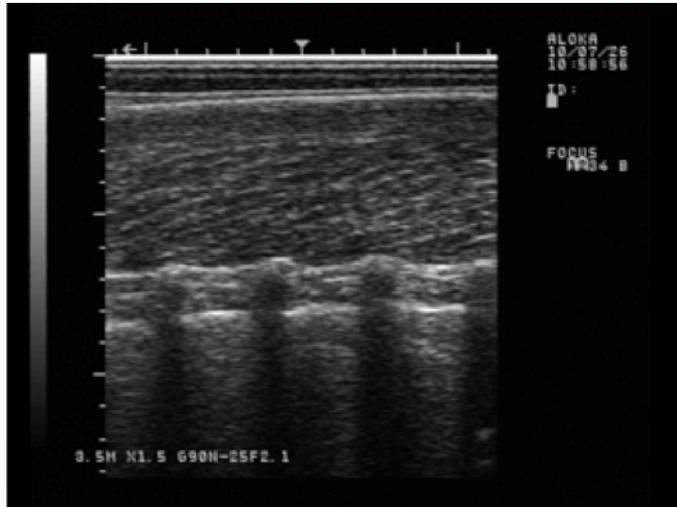


Use of loin intramuscular fat content predicted with ultrasound technology in the Canadian swine improvement program



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(2) Centre de Développement du Porc du Québec inc., Quebec City, Canada



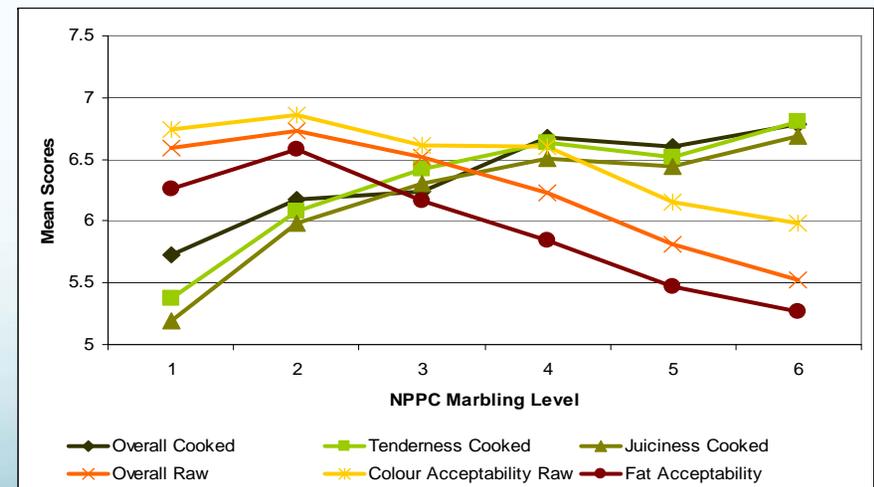
Background (1)

More and more emphasis on product quality, product differentiation and increased demand for marbled pork

- Canada exports about 60% of its pork production to more than 140 countries
- Key markets: Japan, US, Russia, South Korea, Mexico, Hong Kong
- High marbling levels required for Asian and Mexican markets (6-7% IMF)

- Domestically, requirements about 2% IMF but variability exists

Cooked and Raw preferences



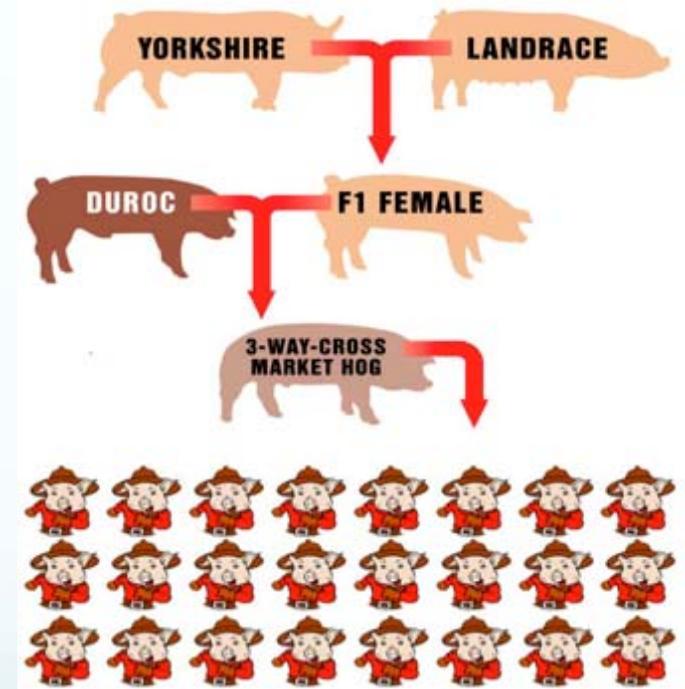
Agriculture and Agri-Food Canada, 2008



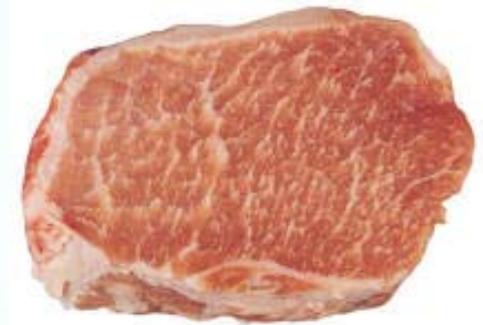
Background (2)



- Traditionally, Canadian hogs are produced from F1 sows and Duroc boars, well-known for good marbling levels
- Selection for leaner carcasses in the last decades, in dam lines and sire lines
- Probable decrease in intramuscular fat % (IMF)
- Current level of loin IMF 2 to 2.5% in commercial pigs, with large variation
- Recent signals from the packing industry (concerns about low marbling)



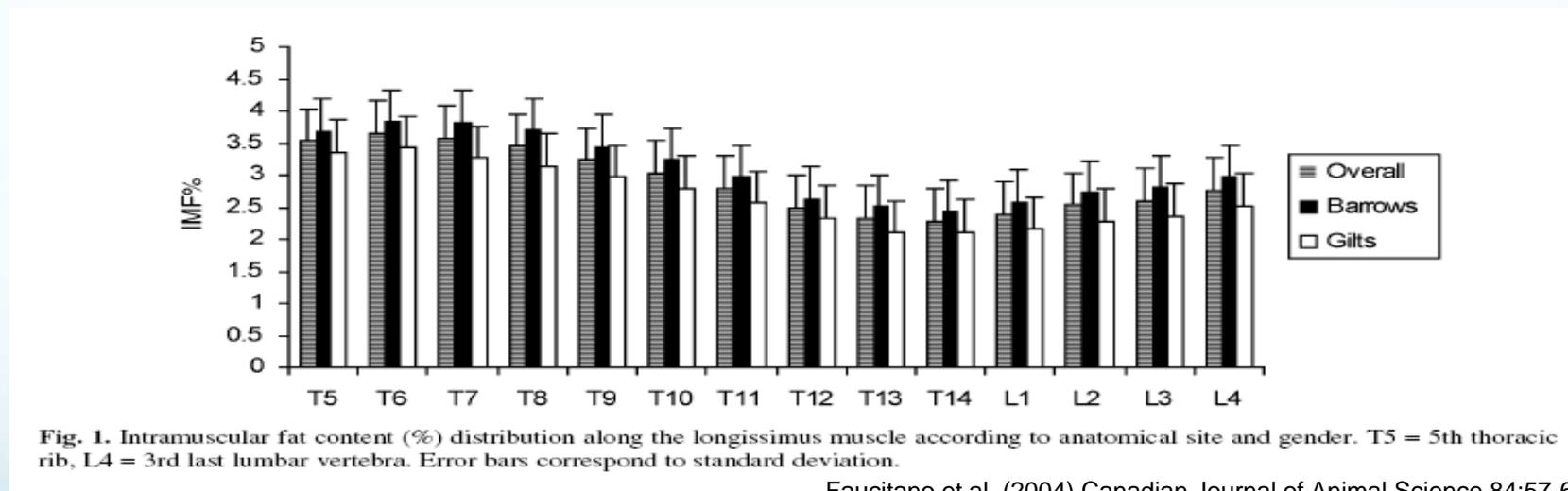
IMF and Marbling



- Intramuscular fat (IMF) content in the loin muscle

← Shoulder

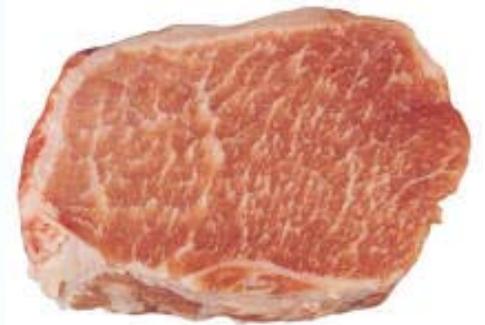
Ham →



EAAP 2011 – Stavanger, Norway



IMF and Marbling



- Intramuscular fat (IMF) can be measured by chemical analysis or spectral analysis (laborious & expensive)
- Prediction using marbling scores (visual & subjective) on a loin cross-section or digital image analysis



- Both methods require animal slaughter, traceability, and cutting the loin



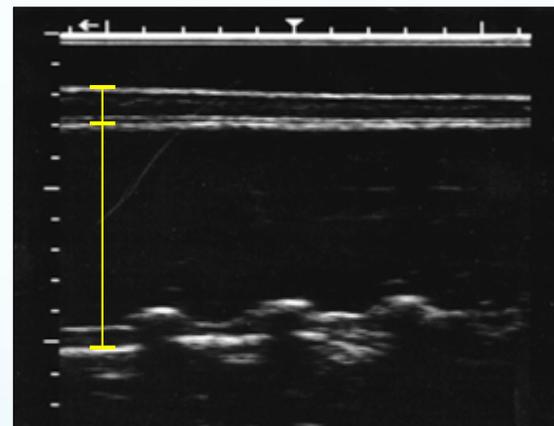
Approach

- IMF is heritable ($h^2 \sim 0,50$)
- Carcass measurements are expensive and tricky
- Approach: Develop an *in vivo* measurement that would be:
 - ✓ Accurate
 - ✓ Practical in farm conditions
 - ✓ Affordable
 - ✓ Used to measure all selection candidates



Prediction of loin IMF in pigs

- Ultrasound technology has been used for many years in pig production, for various purposes (pregnancy checking, measurement of backfat, lean depth, loin eye area, etc.)



- Loin intramuscular fat represents a different challenge, with a 3-dimensional distribution within the loin



Prediction of loin IMF in pigs



- 1995-1997: software developed at Iowa State University to predict IMF on beef cattle, based on signal- and image-processing technologies
- 2000-2007: Research at Iowa State University to adapt technology for swine (Schwab & Baas, 2006)
- 2006-now: Biotronics Inc. (Iowa) develops a commercial toolkit for use in swine (Biosoft Toolbox II for Swine)
- 2007-2008: technology tested by senior technicians in Canada

Biotronics Inc.



IMF scanning in swine Equipment

Aloka SSD-500V Scanner
UST 5011 12.5cm 3.5 MHz
Body composition probe



Aquila Vet
with ASP 18cm probe



Laptop &
« BioSoft ToolBox II
for Swine » Software



Sensoray Frame
Grabber Board

BioSoft Toolbox for Swine: Offline Interpretation ver. 1.00 (c) 2006 Biotronics, Inc.

License Exit

Session Images

All Images
C:\...22-06 images

- P514.P1
- P514.P2
- P514.P3
- P514.P4
- P514.P5
- P514.R1
- P515.P1
- P515.P2
- P515.P3

All Animals

Next Animal
P527

Animal Images

Next Image

- P527.P1
- P527.P2
- P527.P3
- P527.P4
- P527.P1

Scanner
Aloka500w2x

P (% IMF) Image R (LOINEYE) Image U (ALTERNATE) Image

ALLTECH3 NM ISU

ALOKA
00/07/08
22:05:08

ID:

FOCUS:
1034 B

3.5M X1.5 G90N-25F2.1

10th rib

Animal Results

PFAT

3.76	<input checked="" type="checkbox"/>	%IMF1
3.54	<input checked="" type="checkbox"/>	%IMF2
2.32	<input type="checkbox"/>	%IMF3
3.15	<input checked="" type="checkbox"/>	%IMF4
	<input type="checkbox"/>	%IMF5

Avg %IMF
3.48

Process %IMF

LOINEYE/FAT

	<input type="checkbox"/>	R1	
	<input type="checkbox"/>	R2	

Avg LEA Avg FAT

Measurement Tool

Line Box Area

ALLFAT

	<input type="checkbox"/>	U1
	<input type="checkbox"/>	U2

Avg FAT

Save Animal Results

Session ID: Animal: 108 Images: 558 4 2427 3/27/2006 9:52 PM



Prediction of Ioin IMF in pigs

- 2009: inclusion of IMF scanning in the Canadian Accreditation Program for Swine Technicians



National Standards
Officer

Level II technicians

Level I technicians



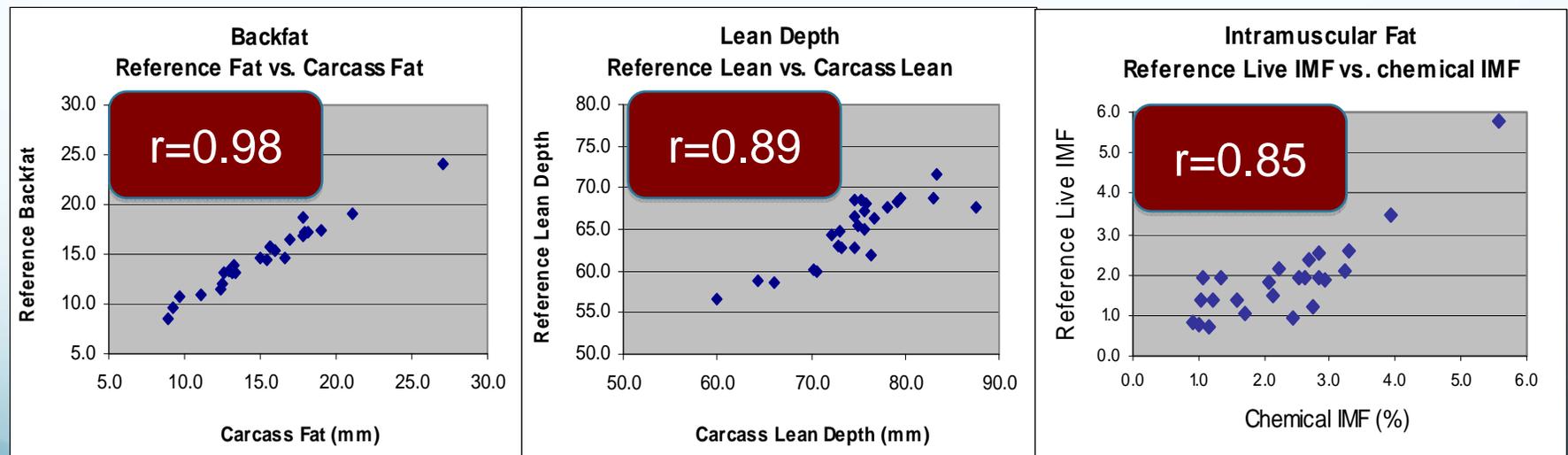
National Standards Session – May 2011

- Annual meeting for level II technicians
- Discussions about new equipment, training sessions, new traits
- Scanning 25 pigs twice for backfat, lean depth and IMF



National Standards Session – May 2011

- 9 level II technicians accredited
- Reference measurements computed as the average of 2 senior technicians
- Comparison live/carcass data



Web tools for Swine Technicians

- As in beef, scans have to be analyzed remotely in order to predict loin IMF %



- Images analyzed and results loaded into CCSI database within 48h



Web tools for Swine Technicians

srael Michaud

Scan:

Scan Date Range (YYYYMMDD)

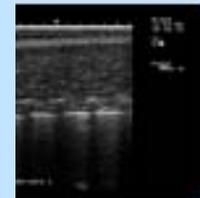
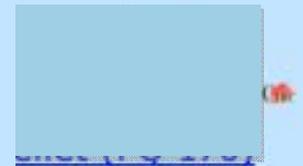
Go!

Herd	Visits	Animals	Images Analyzed	Images Rejected	% Rejected
Fast Pigs Inc.(H&M) (SK 1735)	47	1691	14068	664	4,7

CLRC Re

Summary of Rejected Images

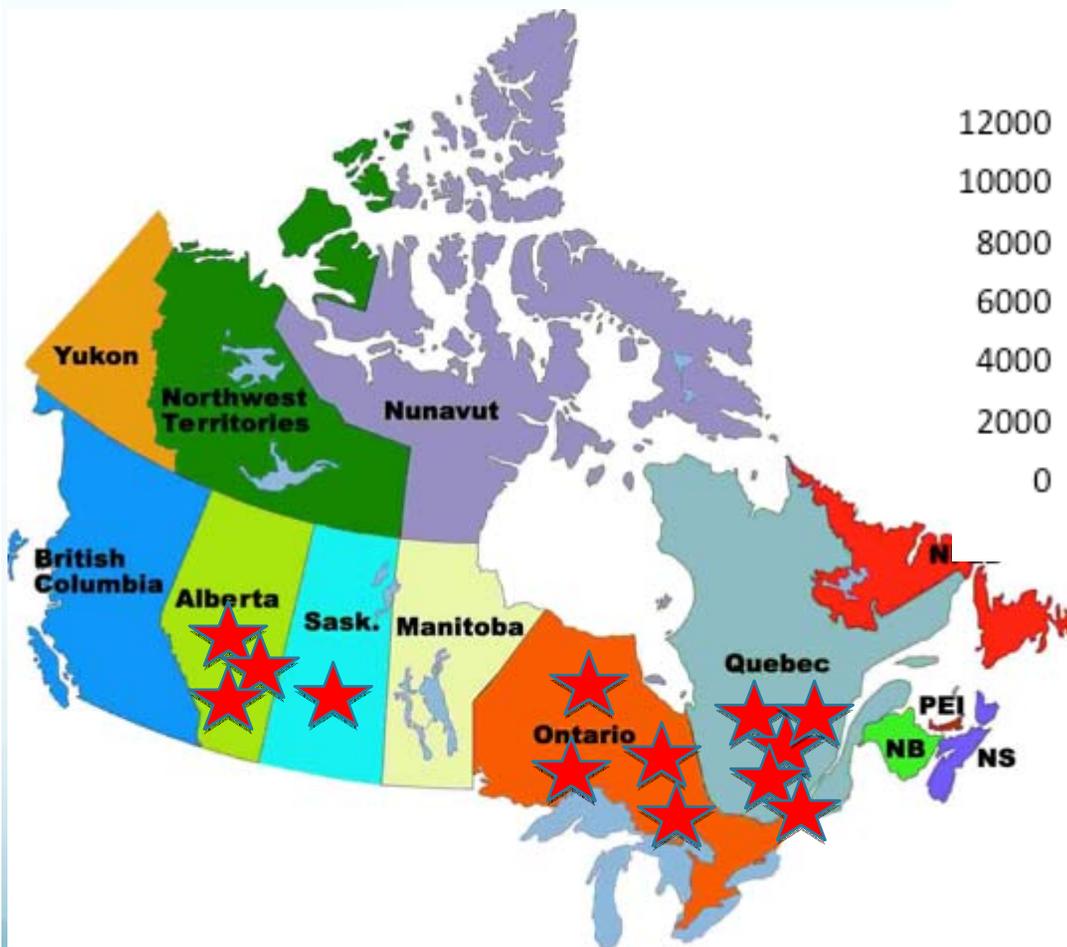
Reason	Images	Percent
Poor Contact	53	8,0
Same image as 8	1	0,2
SAME IMAGE AS THE ONE BEFORE	2	0,3
Abnormal	1	0,2
Blur	147	22,1
Dark	292	44,0
Wrong Position	97	14,6
Interference	20	3,0
Echos	2	0,3
SAME IMAGE AS PREVIOUS ONE	1	0,2
Same image as 5	1	0,2
Incomplete Frame	47	7,1



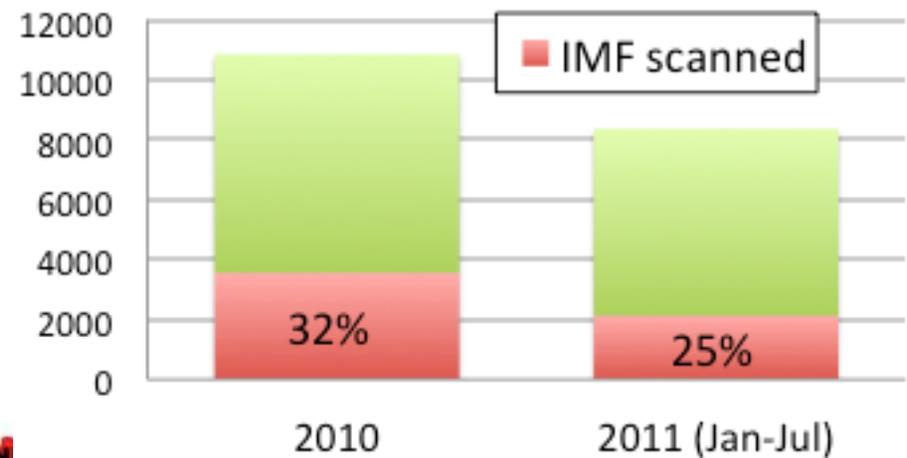
MF Scan
nage #7



IMF scanning status



Duroc Pigs scanned in 2010-2011



-13 farms providing data from 4 provinces



Genetic Parameters

- 5,853 Duroc pigs scanned for backfat (BF), muscle depth (MD), and live IMF between 2008 and 2011

	Live IMF	BF100	MD100	AGE100
Live IMF	<u>0.51 ± 0.02</u>	0.24	-0.20	0.11
BF100		0.54 ± 0.02	0.28	-0.27
MD100			0.43 ± 0.02	-0.10
AGE100				0.26 ± 0.04

Heritabilities on diagonal; genetic correlations above diagonal



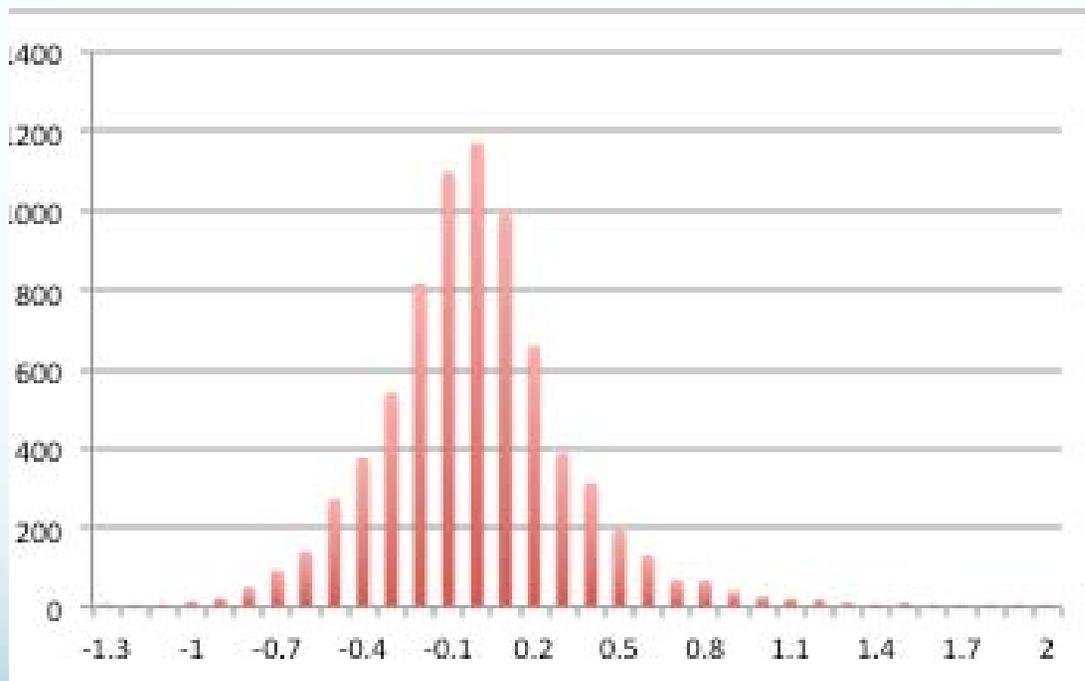
Genetic evaluations for live IMF

- Multi-trait BLUP evaluation including live and carcass traits:
 - Backfat, lean depth, loin eye area, live IMF
 - Loin pH, luminosity, colour score, drip loss, marbling score
- Specific management groups used for live IMF (to account for some 'session' effects)
- Daily runs available on line



Genetic evaluations for live IMF

Distribution of IMF EBVs for
Duroc pigs scanned in 2010



Range of about
3%

IMF EBVs now
available for most
AI boars



New Research Project

Production of Highly Marbled Canadian Pork by Combining New Technologies, Quantitative Selection and Feeding



Partners

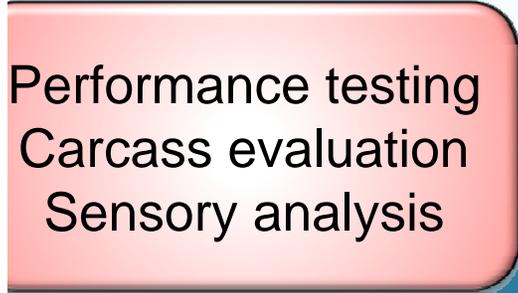
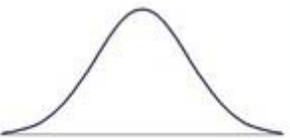
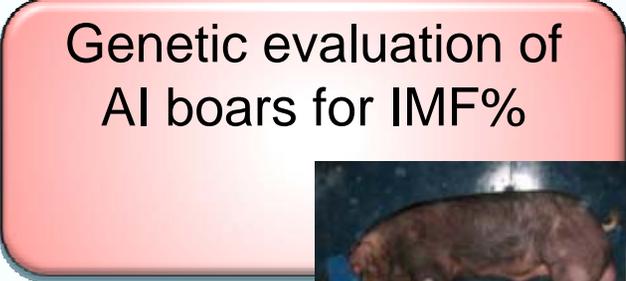
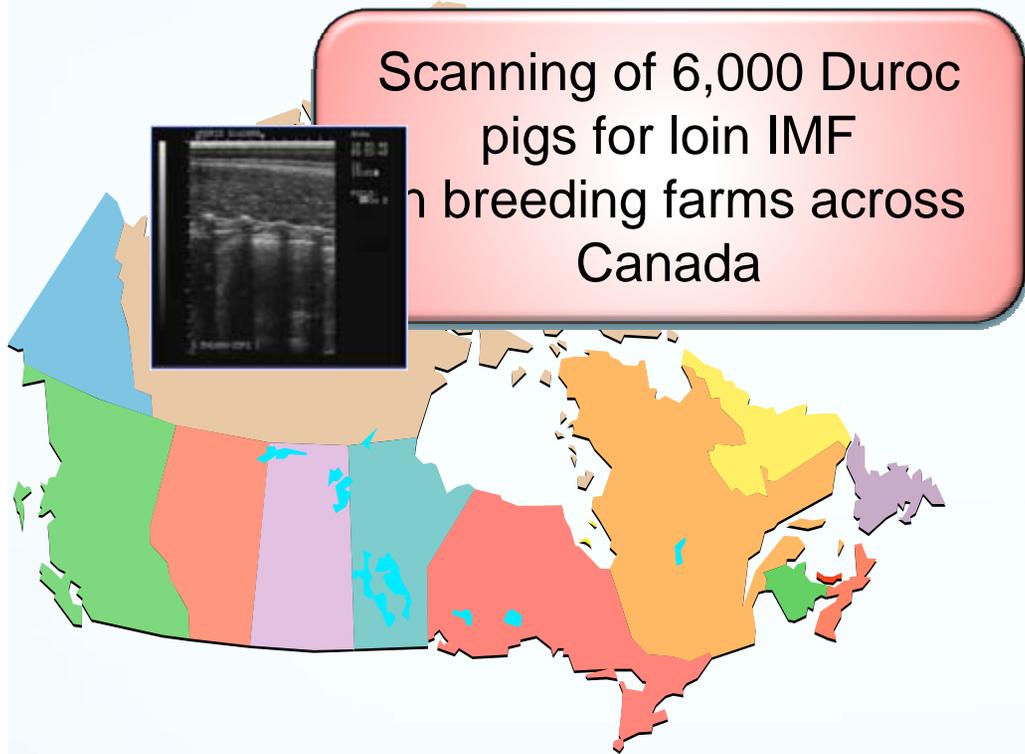
Canadian Centre

for Swine Improvement

Regional Centres

Agriculture and Agri-Food Canada





	Low IMF EBV	High IMF EBV
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	Low IMF EBV	High IMF EBV
Standard feed		
Alternate feed		



vanger, Norway

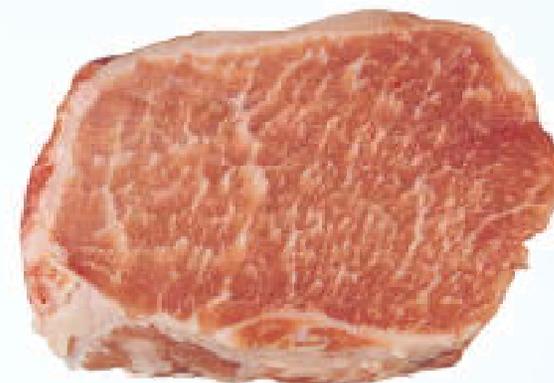


Project objectives

- Provide objective methods to produce desired levels of loin marbling in commercial hogs at the current slaughter weight, through the optimal combination of genetics and feeding.
- Provide standard methods for the evaluation of marbling in live pigs or carcasses (including new technologies such as hyperspectral analysis)
- Provide tools for Canadian breeders and producers to meet quality requirements for high-value products in the coming years



Summary



● National database established

- ✓ About 7,000 purebred pigs with IMF scan data
- ✓ Web-based information system in place to centralize images and results, and improve training
- ✓ EBVs for live IMF available daily

● Standards and technician training are key factors

● These steps are essential to develop real-time measures on portable equipment

● Potential for large meat quality datasets for genomic studies



Acknowledgements

- Participating breeders
- Regional Centres in Atlantic Canada, Quebec, Ontario, Western Canada
- Canadian Swine Technicians

- Financial support from the CAAP Program of Agriculture and Agri-Food Canada



Agriculture and
Agri-Food Canada

Agriculture et
Agroalimentaire Canada



Thank you for your attention !

