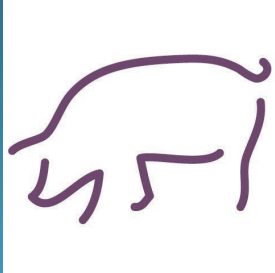


# Meat Quality

S. Lyngesen  
November 2018



## Pork meat quality 豬肉的品質

- Eating quality of pork is the experience the consumer receives when consuming a piece of cooked meat.  
豬肉的賞味品質即是消費者在品嚐一塊肉時的感受
- Darkness, juiciness, taste, color and appearance are the qualities that are immediately considered to be the most important for eating quality.  
暗色、多汁性、味道、顏色與外觀等特質被認為是最重要的賞味品質要素

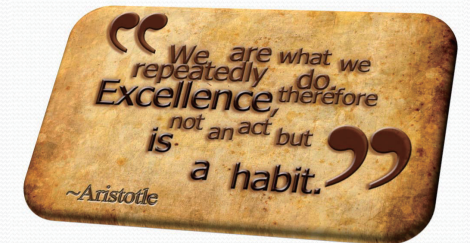


## Definitions of quality 品質的定義

- Quality is a term that is often discussed and on which there are many definitions in different perspectives.
- **The first four definitions:** 4個品質的定義
  - Excellence
  - Successful Products
  - Objective quality parameters and Subjective quality parameters are very general.
- **Quality parameters such as:** 品質的要素有:
  - Nutritional Quality
  - Health Quality
  - Eating quality
  - Technological quality
  - Microbiological quality
  - Ethical quality, definitions are more defined and have a sharper focus on a single parameter in terms of quality.

## Excellence 傑出

- “**Excellence**” is a philosophical term which denotes the ultimate best level that meets the highest standards.
- At the general consumer is involved, this is a sense in which it is known when the unique meets.
- Additionally identified this type of quality from opinion-makers such as food critics and star chefs.





## Successful Products 成功的產品

- **"Success Products"** is another definition of quality can be measured by whether the product belongs to many people's taste.
- It can be argued that this way of defining quality is in contrast to excellence concept, but there is not necessarily disagreement between the two approaches.



## Objective quality parameters

客觀的品質要素

- Here it is usually qualities that directly or indirectly can be measured or weighed.
- It is difficult to define a single uniform standard for quality in food and therefore is an approach to do so, to measure quality based on standards such as legislation and food standards.
- An approach to measuring quality in food may therefore be based on "objective quality parameters" where the individual characteristics that describe or express a product evaluated.
- This can include sensory parameters such as appearance, taste, smell and consistency and the raw materials and ingredients used.



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## Subjective quality parameters

主觀的品質要素

- Food quality is however also with the consumer's cultural and religious beliefs, as these factors influence the food and food culture they are brought up with and thus are used to eating.
- The food will be evaluated by the consumer based on cultural and ethical (such as ecology and sustainability) considerations within the sensory attributes are assessed.
- There is in this quality definition speak of "subjective quality parameters", where quality assessment is influenced by who the consumer is and whether the consumer's expectations are met, as well as price and in what environment the food is eaten in.



## Eating quality 賞味品質

- The eating quality or organoleptic quality, as it is called in other words, quality defined by the experience of the individual gets by eating the product.

**Examples of areas of focus within the eating quality are:**

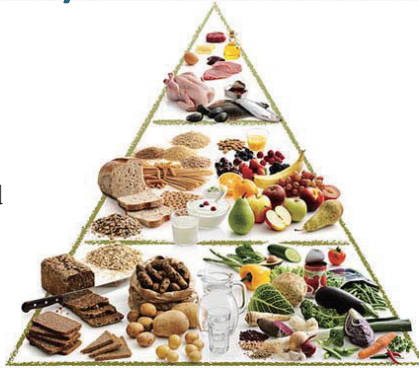
- Content of flavors and aromas? - Absence of taste impairing substances - off flavor
- Absence of taste impairing substances from microbial spoilage? - Texture / consistency? - Juiciness





## Nutritional quality 營養的品質

- By the nutritional quality of food is the focus of their nutritional value.
- Here it is considered a quality that there is a content of the required nutrients in the desired quantities.



Examples of areas of focus:

- Macro-nutrients (fat, protein and carbohydrate)
- Micro-nutrients (vitamins and minerals)
- Energy and energy distribution

## Health related quality 與健康有關的品質

- When quality is defined by a health approach is the absence (limits) of harmful substances into focus.
- It is considered as a quality that the product complies with the limits set for the different substances.



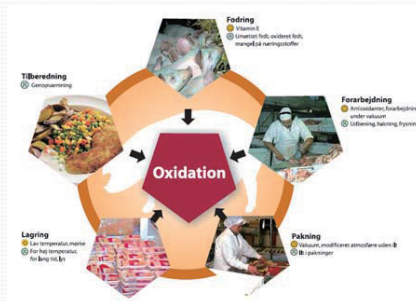
Examples of substances with limit values:

- Heavy metals (lead, cadmium, mercury)
- Pesticides
- Nitrate / nitrite
- Hormones
- Antibiotics
- Bacterial
- Mycotoxins (discharged, ochratoxin, ergot toxins)



## Technological quality 可加工處理的品質

- When quality is defined in terms of the technological quality is suitability of technological processing, which is in focus.
- It may, for example be the meat water-holding capacity and thereby the meat processing ability.



Examples of technological excellence:

- ✓ Composition and structure
- ✓ Functional properties

## Microbiological quality 微生物的質量

- The microbiological quality focuses on durability and disease risk.
- Here the focus is on whether the product is bad within the specified expiry date.



Examples of focus areas of microbiological quality:

- Absence of unwanted bacteria and their toxins? -
- Absence of undesirable molds and their toxins



## Ethics / ecology 道德/生態

- A large number of consumers today defines the quality of products based on personal opinion on how the products are made.

### Examples of areas of focus in ethics / ecology:

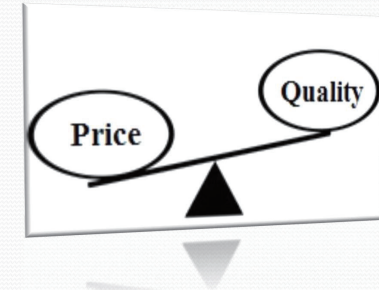
- Growing Forms - Growing Conditions (welfare) - Genetically modified products



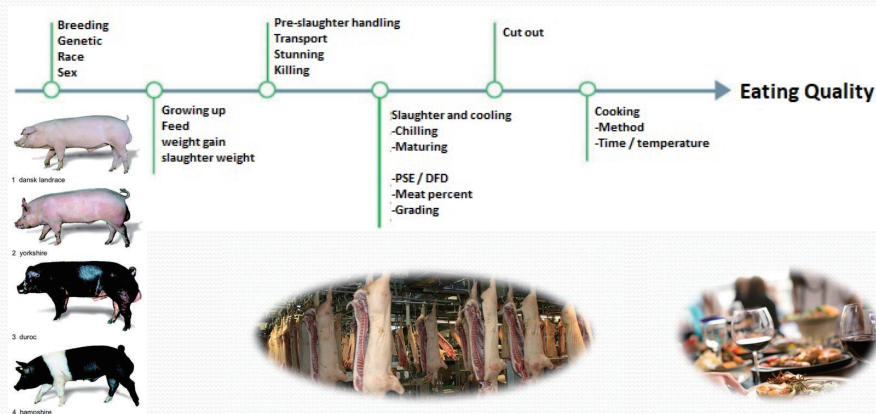
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## Price 價格

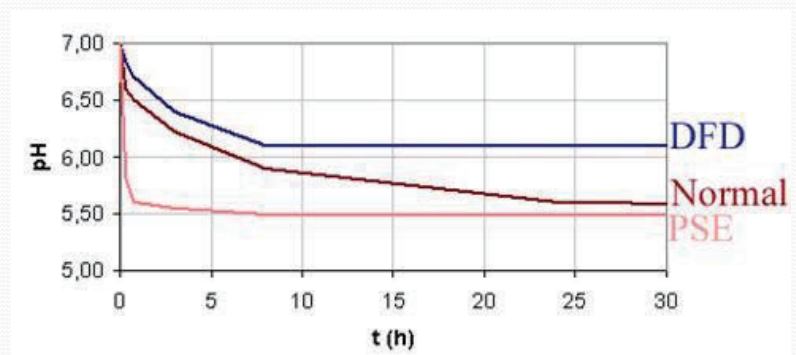
- Another example of the definition of the quality is the price.
- Some consumers define products based on how much money they have to pay for it.
- While some consumers for example believe that it is a quality in itself to find the products as cheaply as possible,
- Other consumers have a different opinion and say that expensive products are quality products.



## Influence on Eating Quality 對賞味品質的影響

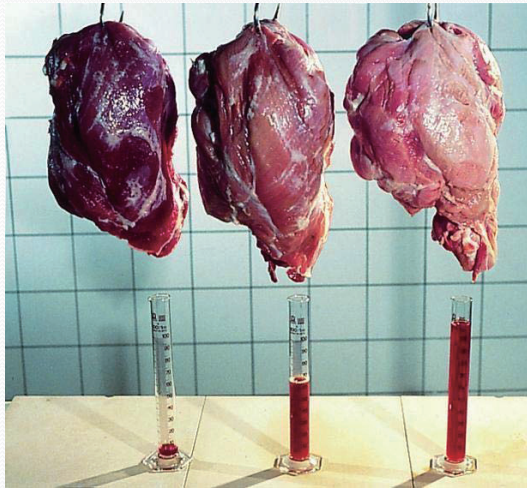


## pH in pork meat 豬肉的pH值變化



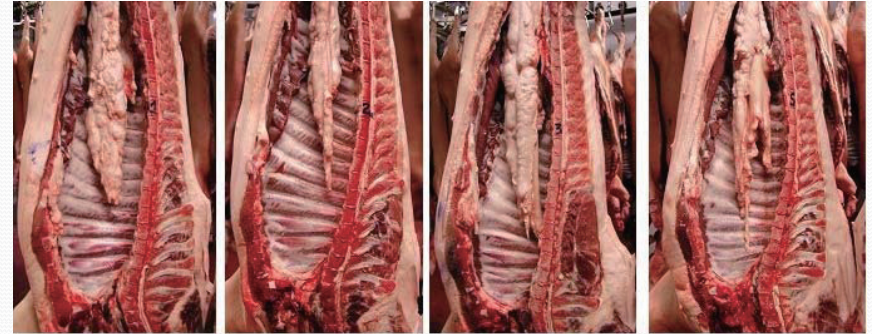


## PSE / DFD 水様肉/暗乾肉



DFD pH: 6,2    Normal pH: 5,7    PSE pH: 5,2

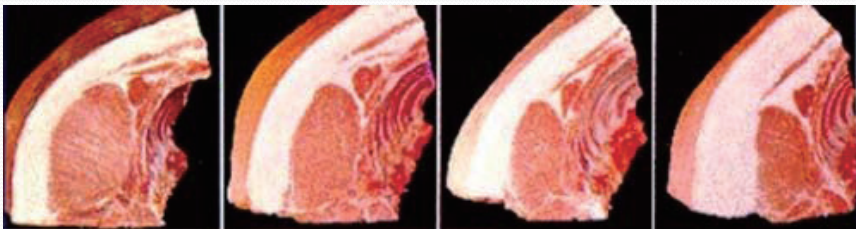
## Carcass grading 屠體評級



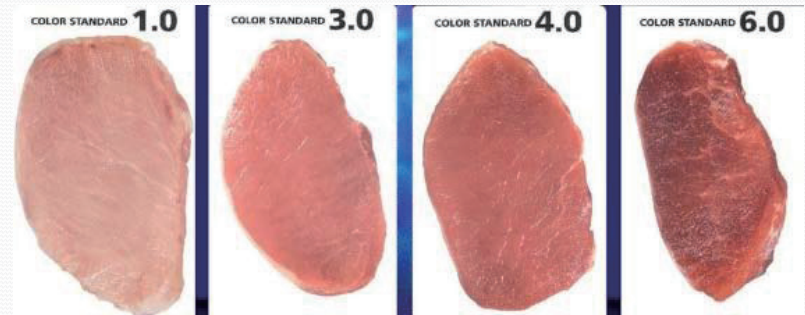
<b>A.</b> Carcass Wgt: 95.5 kg Back Fat: 16.5 mm Muscle: 60.0 mm Est. Lean Yield: 61.5%	<b>B.</b> Carcass Wgt: 94.7 kg Back Fat: 14.0 mm Muscle: 60.5 mm Est. Lean Yield: 62.7%	<b>C.</b> Carcass Wgt: 96.2 kg Back Fat: 24.5 mm Muscle: 61.5 mm Est. Lean Yield: 58.2%	<b>D.</b> Carcass Wgt: 95.7 kg Back Fat: 28.0 mm Muscle: 57.0 mm Est. Lean Yield: 56.8%
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## Fat thickness 脂肪厚度



## Meat Color 肉色





# Marbeling 霜降程度



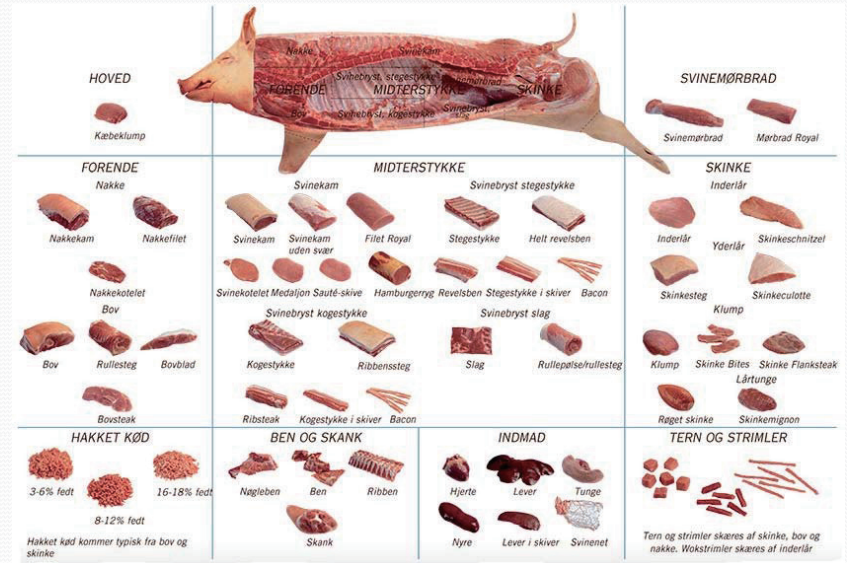
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# AUTOFOM III

- GRADING
- Data in genetic programs
- Source: FRONTMATEC



# Sample: Prime Cut outs 主要分切部位



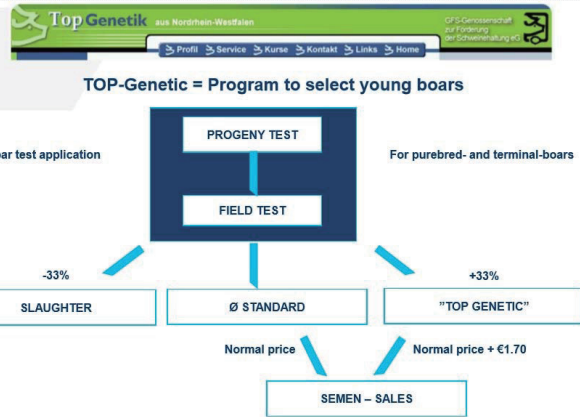
# IMPROVEMENTS IN GENETICS 遺傳上的改進

- Development of pigs with higher commercial value by using AutoFomTM data.  
藉由使用AutoFomTM培育具有更高商業價值的豬隻
- Encourage pig producers to produce “tailor made” pigs for the meat factories through an adapted payment matrix and consultancy services to assist farmers.  
鼓勵豬農生產為肉品工廠量身訂做的豬隻，並藉由支付矩陣的應用與諮詢服務來協助農民
- In Germany AutoFomTM data is used in the breeding programmes.  
在德國，AutoFomTM的資料被應用在育種計畫中
- Experiences from Germany: Improvements in genetics takes from 5-7 years but with a potential of high return of investment for the pig industry.  
以德國的經驗，遺傳的改進需要花上5-7年，但對於養豬產業具有高投資報酬率的潛力
- How is this done?.....  
這是如何做到的呢？



# TOP GENETIC

## "TOP GENETIC"

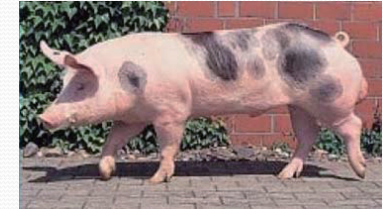


用電腦程式選公豬

# "TOP GENETIC" – TEST PROGRAMS 檢定計畫

- Young boar is bought (Breeder/Hybrid)
- Company/Auction)
- Passes quarantine
- Taken to AI station
- Behavior is tested
- Semen is tested for quality/fertility

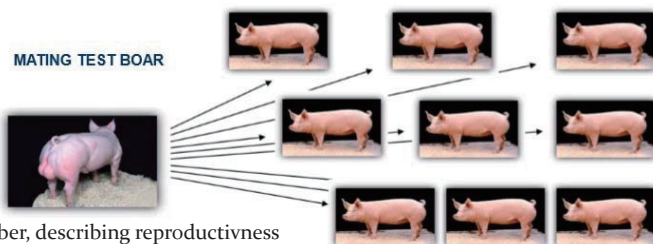
Test application  
 Young boar → Test boar



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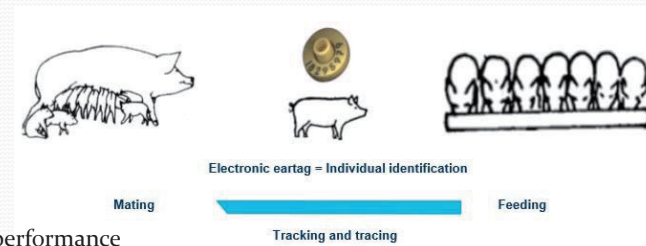
# "TOP GENETIC" – BREEDING 育種

- Test Application – Performance in breeding
- 30 Sows (Purebred 50 Sows) are mated (inseminated) with the test boar on various farms
- All results (conception rate, farrowing date, numbers of piglets, etc.) are registered in EDP „Sow Planning Programme“ (esp. hereditary defects)



# "TOP GENETICS" – FEEDING 飼養

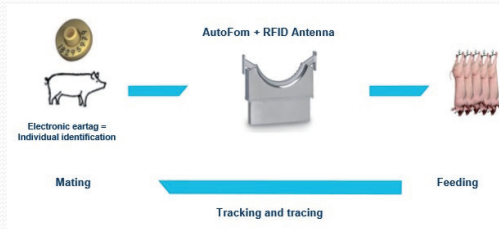
- Test Application – Performance in Feeding
- All piglets are marked with an electronic eartag
- All piglets are fed in the feeder barn until they are ready for slaughtering
- All results (feed intake, feed conversion ratio, weights, losses, etc.) are registered



## "TOP GENETIC" – SLAUGHTER VALUE 屠宰價值

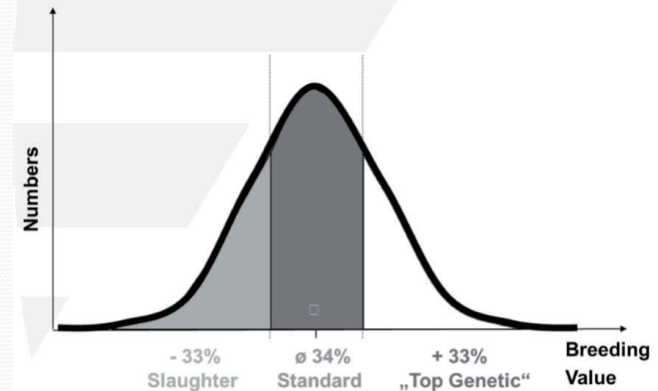
- Test Application – Performance in Slaughtering
- In the slaughterhouse all relevant data like HCW, classification, AutoFom values (primal weights, LMP, belly etc.) are captured
- The pig is identified by its electronic eartag (antenna in the AutoFom trough)
- The data is matched with the pig identification automatically

Slaughter performance



## BOARS = TOP 10% OF ALL QUALIFIED BOARS

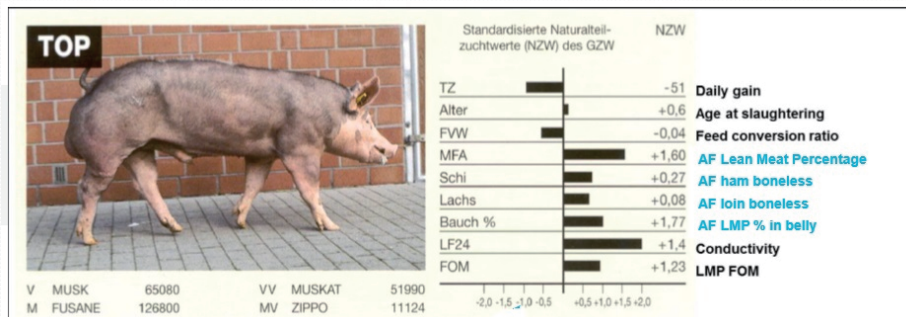
GFS BOARS = TOP 10% OF ALL QUALIFIED BOARS



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## "TOP GENETIC" – COMPARISON 比較差異

- Highlight the difference of a „Top Genetic“ boar compared with the average of the test



## DEVELOPMENT AFTER 5 YEARS 5年後的发展

	Today	5 Years ago	Diff.	Diff. rel.
Numbers of animals	31.075	4.207	26.868	
HCW, kg	94,45	93,75	0,70	0,7%
Netto Gain / Day, g	465	453	12	2,6%
Shoulder, kg	8,19	8,08	0,11	1,4%
Loin, kg	6,99	6,84	0,15	2,2%
Belly, kg	14,76	14,84	-0,08	-0,5%
Ham, kg	18,10	17,70	0,40	2,3%
LMP Belly, %	52,30	50,60	1,70	3,4%
LMP, %	58,20	56,30	1,90	3,4%

Progeny Test of AI-Boars from Race Pietrain

Source: GFS/SNW



# Fully Automatic Ultrasonic Carcass Grading – AutoFom III

## 全自動超音波屠體評級



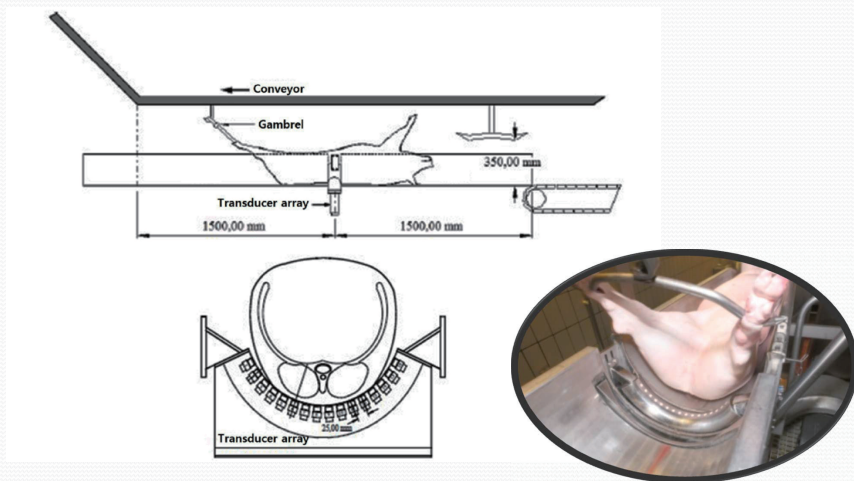
Source: Frontmatec

# AutoFom III - Highlights 亮點

- The most accurate instrument in the world for quantifying pig carcass value  
世界上最精確的豬隻屠體價值測量量化設備
- 100% automatic - grades more than 99.8% of all carcasses even at high line speeds  
100%自動化，99.8%的屠體可以在高速下進行分級
- The only system which provides robust and accurate information about primal value  
唯一可提供穩健且正確的原始數據的系統
- Provides exact knowledge on cut-floor performance  
提供準確的表現知識
- Enables production planning decisions on the basis of verifiable data rather than on assumptions  
依據可驗證的數據而不只是假設來訂定生產計畫
- Provides valuable feedback for genetic development  
對遺傳改進提供有價值的回饋

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# How it works



# SEUROP Grading 評級

Classes	Lean meat as percentage of carcass weight (%)
S	60 or more
E	55 or more but less than 60
U	50 or more but less than 55
R	45 or more but less than 50
O	40 or more but less than 45
P	Less than 40

Table 1 The Community scale for classification of pig carcasses. Source: Regulation (EU) No 1308/2013



## The production management tool for the pork industry

### 給肉豬產業的生產管理工具

- Since its launch in 1994, AutoFom has revolutionized the world's pork industry with its ability to accurately and automatically quantify the commercial value of pig carcasses.

從1994年推出以來，AutoFom藉著其準確且自動化的量化豬屠體商業價值的能力，改變了世界豬肉產業。

## This is how it works

- AutoFom III™ uses advanced ultrasonic image analysis. The system provides information about classification, i.e. the total lean meat percentage and grading class (SEUROPE).  
AutoFom III™使用先進的超音波影像分析。此系統可提供如總瘦肉率與分級等資訊。
- AutoFom III™ can also provide the lean meat percentage, weight of lean meat and total bone-in/ bone-out weight of the 4 primal cuts (ham, shoulder, loin and belly).  
AutoFom III™也可提供瘦肉率、瘦肉重與4各主要分切部位的重量。
- AutoFom III™ can be configured to predict commercial cuts and also specific traits like loin and ham fat thickness in order to meet the requirements of the customer.  
AutoFom III™可因應客戶對特定部位的需求或一般的商業分切做設定。
- The yield information permits the slaughterhouse to optimize the sorting of the primal cuts and pay the farmers according to the exact market value.  
收益的資訊讓屠宰場可以調整分切部分的分類，並且依照確切的市場價格付錢給農民。
- This attracts the best pigs in the market and it encourages the breeding of pigs with high commercial value.  
這吸引了市場上最好的豬，並且鼓勵了具有高商業價值豬隻的選育。

## Precision in payment 精確的付款

- When paying your producers according to lean meat percentage, back fat thickness or other parameters, the absolute precision of the new AutoFom III™ is in a class of its own, documented by many national approval tests.

在依據瘦肉率、背脂厚度等參數付錢給豬農時，AutoFom III™ 可提供受到許多國家試驗認證的絕對精確的數值

- In actual production it is, of course, even less prone to error than a handheld instrument.

在實際的生產現場，其出錯的機會比手動式的設備更少

## Development of pigs with higher commercial value by using AutoFom III™ data

藉著使用AutoFom III™的資料開發具有更高商業價值的豬隻

- Pig producers can be encouraged to produce “tailor-made” pigs for the slaughterhouses through an adapted payment matrix and consultancy services to assist farmers.  
豬農被鼓勵生產為肉品工廠量身訂做的豬隻，並藉由支付矩陣的應用與諮詢服務來協助農民
- Data can be used in breeding programmes and experience shows that improvement in genetics takes from 5-7 years but with a potential of high return on investment for the pig industry  
資料可被應用於育種計畫中，過去的經驗顯示遺傳的改進需要花上5-7年，但對於養豬產業是具有高投資報酬率的潛力

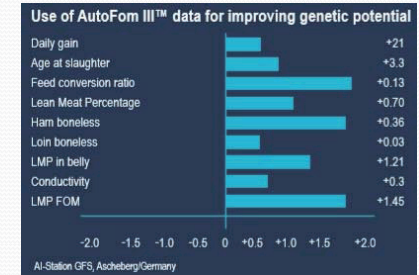


## Genetic comparison 遺傳比較

- In Germany, AutoFom III™ provides input to genetic comparison of the commercial value of litter from various boars by tracking samples via an ear tag antenna over the AutoFom III™  
在德國，AutoFom III™可針對豬隻輸入商業價值的遺傳比較並藉由電子耳標追蹤每頭公豬
- The yield information from AutoFom III™ provides instantaneous feedback for boar selection.  
而AutoFom III™所提供的收益資訊可即時回饋在公豬的選拔

## GFS's boar catalogues GFS的公豬目錄

- An example is depicted in the German company GFS's boar catalogues, where the deviation from industry mean value for each boar in terms of lean meat content by primal, daily gain, age at slaughter, etc. is demonstrated for easy comparison.

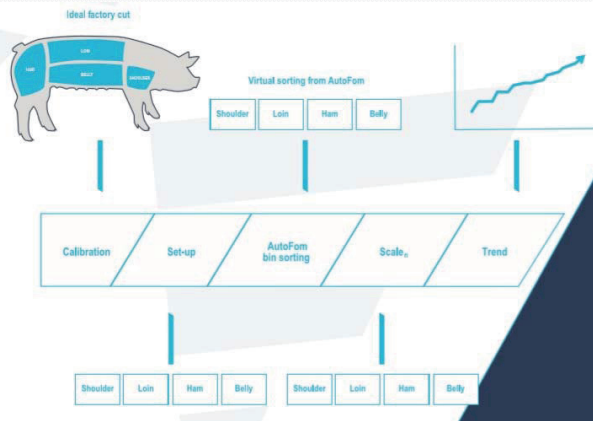


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## Yield management - a tool for the pork industry 收益管理-給肉豬產業的工具

### Continuous improvement with AutoFom III™

The new AutoFom III™ is unique in the world in its ability to accurately predict the quality of a pig carcass prior to any processing steps. With an exceptional precision AutoFom III™ can define each primal cut and the lean meat yield of that cut, thus enabling accurate yield management control of cut-floor performance. With a factory calibration it is possible to monitor changes and/or improvements in the yield.



## Custom calibrations and modelling 自訂校正與模擬

- Frontmatec offers to help develop customer specific models for primals or various commercial cuts in your plant.  
Frontmatec協助你的工廠開發客製化的各式商業分切模式
- For example, Frontmatec offers planning and training of a factory cut-test by experienced meat scientists and experts in chemometric modelling. This ensures that the cuts are reproducible and prediction models can be developed and implemented in the AutoFom III™ using state-of-the-art chemometric modelling.



# The purpose of modelling 模擬的目的

- To develop factory specific sorting specifications  
為了開發每個工廠各自獨特的分類方式

- To develop yield management software to help ensure consistency between AutoFom III™ predictions and available data  
為了開發收益管理軟體以協助確認AutoFom III™的預測與可用資料間的一致性

