다산성 모돈 생산성 향상을 위한 새로운 접근 방법

New Approach to improve the productivity for proliferated sows.

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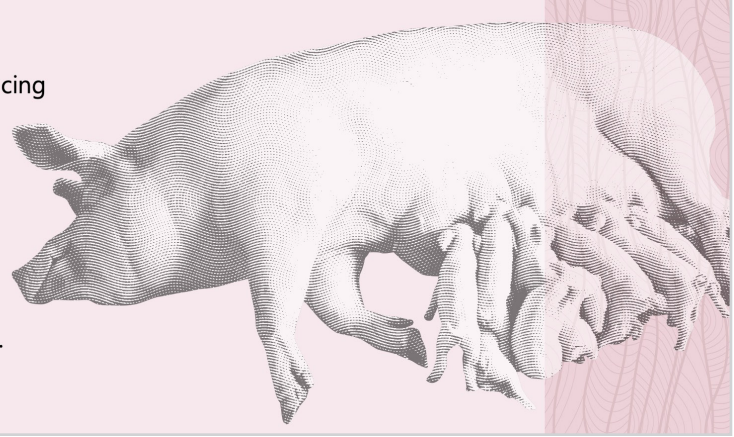
목차 Agenda

1. 과제 : The challenge

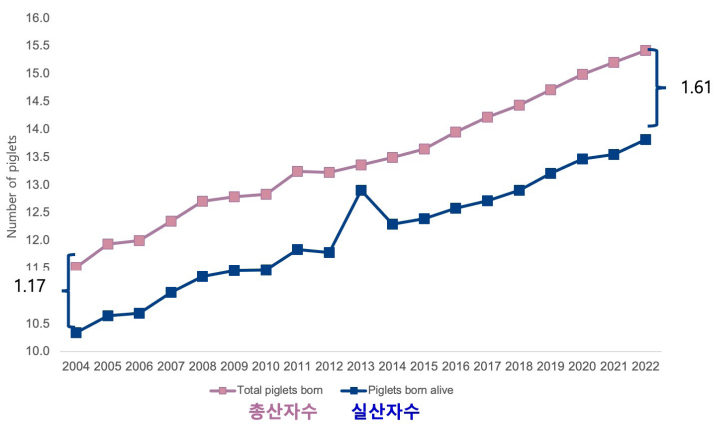
모돈과 자돈 폐사를 줄여야 생산성이 높아진다.
To increase farm output through reducing sow and piglet mortality.

충실한 에너지 공급은 보다 빠른 분만, 보다 강건한 자돈 생산이 필수 요소다.
Better energy distribution for quicker farrowing and better vigour in piglets.



자돈 폐사율 감소 Reducing piglet mortality – overview data

총 산자수와 실산자수
Total piglets born and born alive between 2004 – 2022



Adapted from Pigchamp benchmarking reports

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자돈 폐사율 감소 Reducing piglet mortality – overview data

유럽 복당 실산자수 Piglets born alive (Kemp et al., 2018)

- 네덜란드 : 복당 4두 증가 1996-2016
  Netherlands: +4 piglets/litter between 1996–2016
- 덴마크 : 복당 6.6두 증가 2007-2019
  Denmark: +6.6 piglets/litter between 2007–2019

이유 전 폐사율 4% 증가 Pre-weaning mortality: increased ~ 4%

- 4일령 이내 폐사 발생 Main mortality happening in first 4 days
- 유럽 12~20% Europe: ranges from 12 – 20% (Muns et al., 2016)
- 미국 1.3두/2004→ 2.3두/2022 US: from 1.3 piglet in 2004 to 2.3 in 2022 (Adapted from Pigchamp benchmarking reports)

지난 20년간 미이라발생증가와 PWM로 복당 1.4두 손실
Over 20 years, you are losing 1.4 piglet per litter extra due to higher stillborn and PWM

원인과 해결방안은?
What causes this and how can we solve this?

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시작이 반이다. A good start is half the battle.

이유 전 폐사율
Pre-weaning mortality

자돈의 성장과 건강 유지를 위해 제대로 시작하자.
Start off right and maintain growth and health

모돈 영양은 자돈 출생 시 활력도를 향상시킨다.
Sow nutrition can help to increase piglet vitality at birth

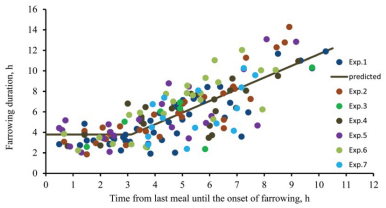
시작이 반이다. A good start is half the battle.

- **이유자돈 폐사는 PSY의 중요 생산성 지표**
  Pre-weaning mortality is an important KPI in pigs with the number of pigs weaned per sow per year a key measurement.
- **신생자돈의 강건성은 이유자돈 폐사율 낮추는 열쇠**
  Piglet vitality plays an important role in reducing pre-weaning mortality
- **이유자돈 폐사의 주요 원인** Pre-weaning mortality is associated with multiple causes
  - **저품질의 초유와 유즙 섭취** Too low colostrum and milk intake
  - **압사** Crushing
  - **저체온증** Hypothermia
  - **위 요인들 상호 연관되어 있음.** These are all interlinked with each other
- **모돈의 충분한 에너지 섭취가 분만과정을 단축시킬 수 있음.**
  A better distribution of energy by the sow will help to shorten the farrowing process
- **분만시간 단축은 나중에 분만하는 자돈의 저산소증을 줄여줌으로써 활력에 도움을 줌.**
  A short farrowing process can help to achieve increased vitality by reducing farrowing hypoxia in later born piglets

미이라 발생을 줄이면서 모돈의 순산을 위해 충분한 에너지 공급이 중요함.

The importance of sufficient energy for a smooth farrowing process to reduce stillborn piglets.

- **총산자수 증가는 분만과정이 길어짐.**
  increased number of pigs has lengthened the farrowing process:
  - **성공적인 분만이란 미이라 발생 10% 이하**
    A successful farrowing is classed as <10% stillbirth rate.
  - 분만기간과 분만간격이 미이라 발생의 중요한 요소
    Farrowing duration and birth interval are key factors for this (Oliveiro, 2010; Feyera et al., 201
- **자돈 분만 시 상당한 에너지 요구됨. 마라톤 경주! 단거리 경주는 아님.**
  Giving birth to piglets requires a lot of energy: it is a marathon, not a sprint!
- **글루코스가 주요 에너지 공급원으로서 분만 전 먹은 사료로부터 4~6시간 후 이용된다.**
  Glucose is the main energy source, becoming available 4 – 6 hours after the last meal.
- **따라서 분만 전 사료 급여는 에너지를 충분히 줄 수 있는 중요한 요소**
  Therefore, feeding before farrowing is important to make sure that sufficient energy is available.
- **분만 전 3시간 이내 사료 급여는 분만기간이 길어진다.**
  Research showed that farrowing duration significantly increases when the time since the last meal is >3 hours (Feyera et al., 2018; Feyera et al., 2021).



Feyera et al., 2018

분만시간과 사료 급여 시간의 상관관계

But what if that energy cannot be utilized properly??

자돈 폐사와 인슐린 저항성 상관관계
Relationship between insulin resistance and piglet mortality

글루코스 장애 수준 Severity of glucose disturbance (mMol/L)	N	자돈 폐사율 piglet mortality
< 1.2	20	1.2 a
1.2 – 1.6	25	4.0 ab
1.6 – 2.2	20	5.3 b
2.2 – 2.6	20	4.4 ab
> 2.6	19	9.6 c

Kemp et al., 1996

모돈의 ~30% 글루코스 대사의 심각한 문제
~30% of the sows has a significant problem with their glucose metabolism (Ying et al., 2021)

- **글루코스는 분만 시작과 빠른 분만율을 위한 가장 중요한 에너지 공급원으로서 자궁근육 수축의 에너지원** (Feyera et al., 2018)
  Glucose uptake and distribution is key energy source for onset of farrowing & quick farrowing rate: energy for the muscle contractions! (Feyera et al., 2018)
- **임신구간 당뇨와 연관된 문제 Linked with insulin resistance :**
  - **자돈 폐사 증가 (Kemp et al., 1998)**
    Increased piglet mortality (Kemp et al., 1998)
    - **분만초기 폐사 발생** Mortality occurs especially in the first days
    - **자돈 저칼슘 상태로 출생. 자돈 활력 떨어짐**
      Lack of thrive of piglets: piglets are born hypoglycaemic
  - **자궁내 성장 제한 : 태아에 영양 공급 부족**
    Intra-uterine growth restriction: insufficient delivery of nutrients to the foetuses
    - **영양공급 장애 및 산소결핍 초래** (Wu et al., 2006 Lorenzo et al., 2019)
      Reduced delivery of nutrients and oxygen to the placenta and foetus
      (Wu et al., 2006 Lorenzo et al., 2019)
- **사료내 임신돈 에너지 수준 +1650 kcal : (Jin et al., 2016)**
  Gestational energy levels in diets +1650 kcal : (Jin et al., 2016)
  - **NRC 1998: 5,028 – 6,532 kcal ME**
  - **NRC 2012: 6,678 – 8,182 kcal ME**
  - **This extra energy comes mainly from more starch**
- **인슐린 저항성의 영향에 대해 해결방안을 찾아보자. 단, 원인을 해결하는 것은 아님!**
  In practice, we are finding solutions for the effects of insulin resistance but not solving the cause!

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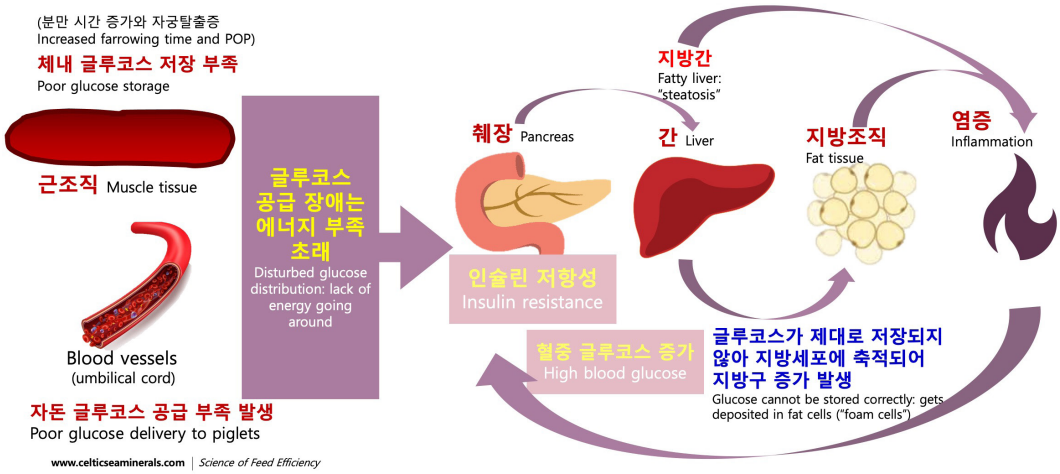
인슐린 저항성 Insulin Resistance

모돈 약 30% 대사성 질병
Present in approximately 30% of the sows in a problematic manner (based on literature and initial on-farm research of CSM)



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2022년 유럽 수의 임신돈의 당뇨 발병 사례 보고

2022 European Veterinary Led Survey of Incidence of Gestational Diabetes in Sows

Sows from 3 different farms were fasted for 12 hours overnight and then blood samples taken for glucose analysis prior to feeding.

Fasting Glucose (mmol/L)	No. Sows	Total Born	Avg Born	Total Live Born	Avg Live Born	% Mortality	% of Sows with mortality	% Piglet mortality in sows with mortality
2.0-4.0	13	219	16.85	202	15.54	7.5%	69%	11%
>4.0	31	552	17.81	487	15.71	11.1%	74%	15%
Kemp et. al., 1996	19	-	-	-	-	9.6%	58%	16.4%

P=0.18

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모돈의 건강과 폐사에 미치는 인슐린 저항성의 영향

Effects of insulin resistance on sow health and mortality

자궁탈출증 Pelvic Organ Prolapses (POP)

- **자궁탈출증은 미국 양돈장 심각한 문제**
  POP is a significant problem in especially the USA.
- **미국 평균 모돈 폐사율 20% 주원인은 자궁탈출증**
  On average in the USA, 20% of the mortality in sows is due to POP (Ross, 2019)
  - This varies from <1 sow death/1000 sows per week to >5 sow deaths/1000 sows per week in farms.
- **원인은 알려져 있지 않으나 자궁탈출증과 상당한 관계가 있음을 연구중임.**
  cause of this is unknown but a lot of research is ongoing with a special POP research team (www.pigliveability.org).
- **인슐린 저항성에 의한 근육강도 저하와 골반평활근 기능 저하가 사람에게도 발생**
  Pregnancy insulin resistance is associated with reduced muscle tone and pelvic floor muscle activation in humans (Prudencio et al., 2022).
- **우리가 자궁탈출증이 모돈의 인슐린 저항성과 연관 지을 수 있을까?**
  Can we relate insulin resistance in sows with increased POP levels?

직장탈출증
Rectal prolapse
Supakorn et al., 2017

탈질과 직장탈출증
Vaginal and rectal prolapse
Supakorn et al., 2017

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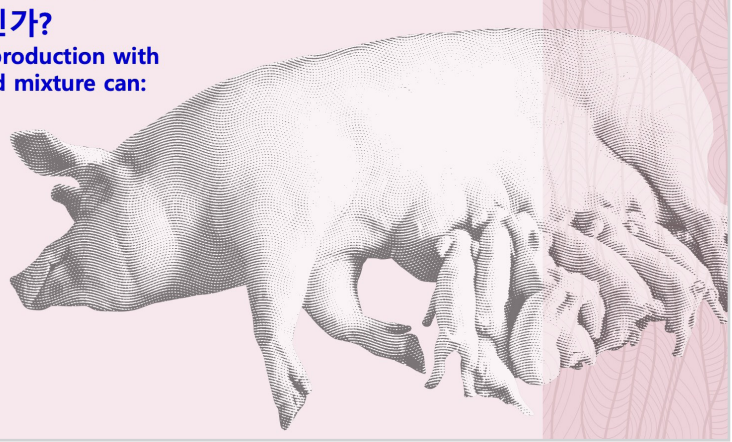
2. 해결방안 The solution

최상의 해조류 혼합물로 모돈의 건강과 생산성을 향상시킬 수 있을 것인가?
Can we improve sow herd health and production with a novel seaweed mixture? This seaweed mixture can:



SWF 기능

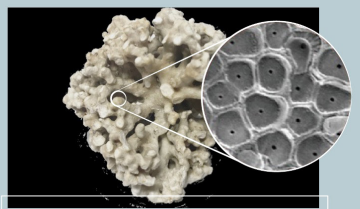
1. 분만 시 에너지 수준 향상
   Improve energy status at farrowing
2. 자돈의 생산성 향상
   Better piglet performance
3. 염증 감소 Reduce inflammation

SWF는? What is it?

SWF는 항염작용하는 생리활성물질과 해조 미네랄 복합체 상호기능 향상을 통해 모돈의 건강과 생산성을 올려준다.
SWF is a unique seaweed formulation with anti-inflammatory bioactives and marine minerals.
SWF's components work synergistically together to enhance sow health and performance.

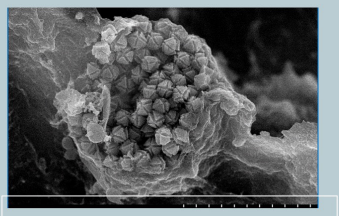
아스코필럼 노도숨(갈조류)과 리토댐니온(홍조류)은 북대서양 아이슬란드 해역에서 지속적으로 수확함.

Ascophyllum nodosum and *Lithothamnion glaciale* sustainably harvested from the north Atlantic waters.



리토댐니온은 독특한 홍조류 유래 해조류로서 생체이용성이 높은 칼슘과 마그네슘 외 72종의 복합광물질 함유

Uniquely Bioavailable marine mineral complex with calcium and magnesium alongside 72 trace minerals.



아스코필럼 노도숨에서 추출한 생리활성물질은 종전 발견되지 않았던 뛰어난 항염작용함.

Previously undiscovered anti-inflammatory bio-actives are extracted in a proprietary process from *Ascophyllum nodosum.*

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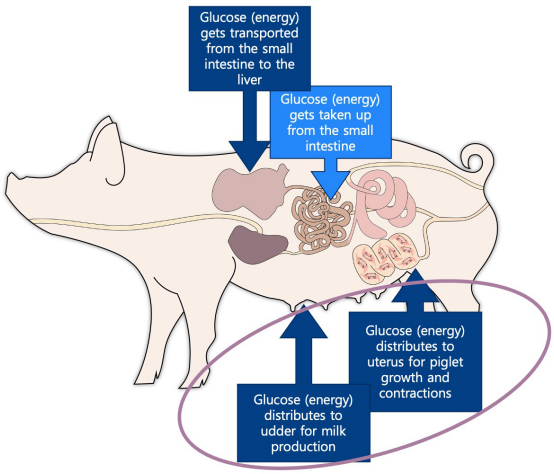
해조류 복합체는 모돈의 글루코스 흡수를 향상시킴.

SWF helps to improve the energy (glucose) distribution of the sow.



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급여 결과 외적인 효과 This results in:

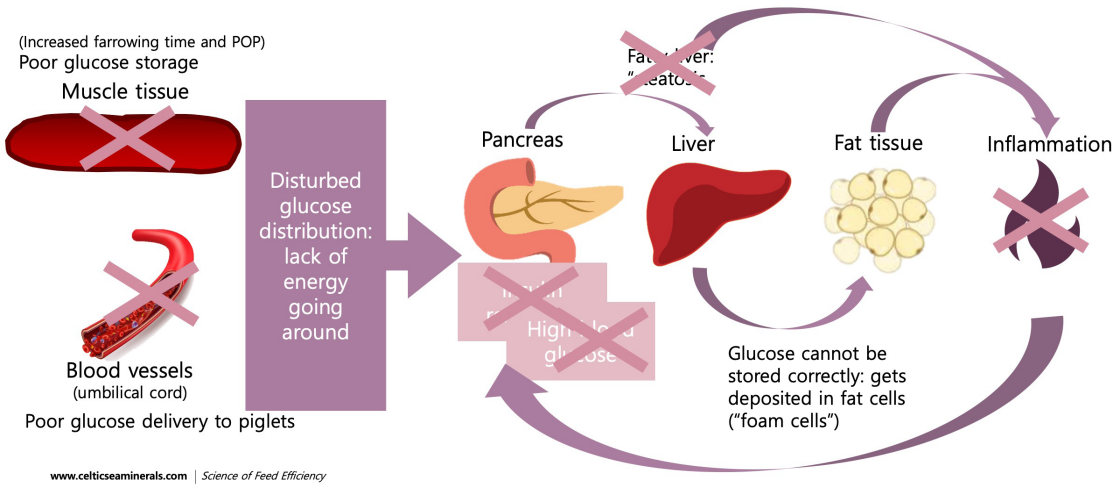
1. 분만 시 에너지 상태 향상
   Improved energy status at farrowing
2. 자돈 활력 증가 Better piglet performance
3. 체조직 내 염증 완화 Reduced systemic inflammation

생산성 지수 This results in:

- 실산자수 증가 0.5 piglet more born alive
- 이유두수 증가 0.65 piglet more weaned
- 이유 시 체중 증가 Piglets are heavier at weaning
- 분만시간 단축 Shorter farrowing time (20 mins)
- *자궁탈출증 감소 Reduced pelvic organ prolapses*

SWF 급여한다면 어떻게 될까?

What happens if we feed this unique seaweed formulation



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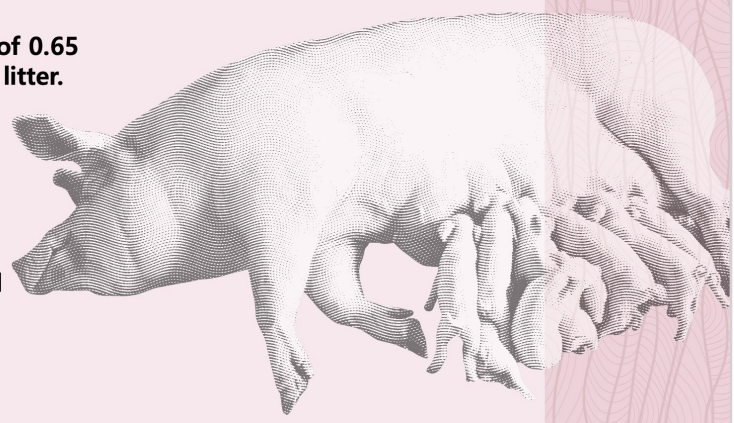
3. 실증 Trials

- **6년여 메타분석에서 PSY 추가 0.65두 향상**
  A meta-analysis over 6 years shows a consistent improvement of 0.65 piglets weaned extra per sow per litter.

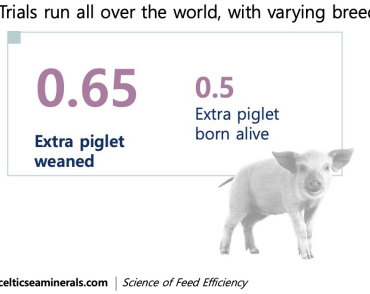
- **단국대 연속 4산 실험 결과 SWF 잠재적 가치 검증**
  A large, 4-parity study in Dankook University highlighted the potential of SWF.



모돈 성적에 대한 메타분석 Meta-analysis sow performance

6년간 8개 논문 평균 이유두수 1.6두 증가
8 studies over 6 years show an average of 1.6 extra PWSY.

- 연구 결과 : 대조구, 실험구
  Studies were analysed as control and SWF treatment
- 대조구 총 2,621두 Total of 2621 control fed sows
- SWF 시험구 총 2,833두 Total of 2833 SWF fed sows
- 실험은 다양한 모돈 품종에 생산성 평가 수행
  Trials run all over the world, with varying breeds and production levels



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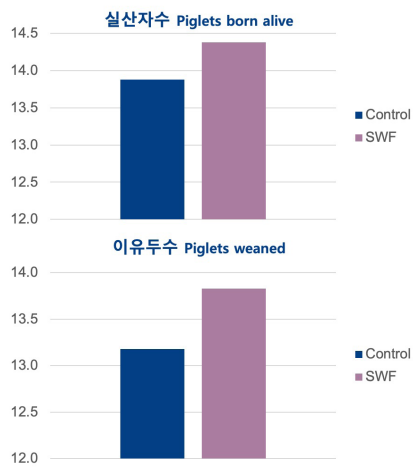

급여 효과(미국, 2022) Impact in use | USA 2022 | Trial at a glance

SWF의 자궁탈출증 감소 효과
SWF reduced incidence of Pelvic Organ Prolapses

실험 목적 TRIAL OBJECTIVE

자궁탈출증 발생이 높은 농장에서 탄산칼슘을 SWF로 톤당 3.6kg(8lb) 부분 대체 발생 감소 측정

To evaluate the effects of SWF in the basal diet as a partial replacement of limestone in a farm with a high prevalence of POP. SWF was included at 8 lbs/tonne of feed to replace 8 lb of limestone.

시험 측정 항목 AS MEASURED BY

- **모돈 2,500두 농장 2개에서 탈출증 발생 비교**
  Two farms with 2,500 sows. Comparison between two similar farms with different incidences of POP.
- **측정 항목** Measurements:
  - **탈출증에 의한 도태** Sows being culled due to POP
  - **지속적인 복당 성적 분석** Litter performance (analysis on-going)

실험 결과 KEY FINDINGS

- **최초 발생 1~8주간 주당 4두/1,000두**
  Initial POP incidence week 1~ 8: 4 POP/1,000 sows/week
- **9~11주차 주당 1두/1,000두**
  Week 9 – 11: 1 POP/1,000 sows/week
- **SWF 급여 후 모돈의 대사 적응 시간 필요함**
  SWF needs time to change metabolic status of the sow
- **도태 모돈 산차 증가, 즉 초산돈의 도태율 저하**
  Sow parity at removal increased from in SWF group: less young sows are being culled

	주당 탈출증 발생수 # prolapses/ week	도태 모돈 평균 산차 Average parity at removal
Control	2.99 ± 0.36 [a]	3.59 [a]
SWF	**1.07 ± 0.79 [b]**	**4.18 [a]**

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SWF 급여 효과 Impact in use | South Korea 2022 | Trial at a glance

SWF의 복당 실산자수 및 이유두수 효과
SWF improved piglets born alive and piglets weaned per sow.

실험 목표 TRIAL OBJECTIVE

사료 내 탄산칼슘 부분 대체, 4연속 산차, 모돈 생산성 향상 효과 평가

To evaluate the effects of SWF in the basal diet as a partial replacement of limestone for four successive parities on the performance of sows and their litters, which consequently had effects on the longevity of sows.

실험 규모 TRIAL SAMPLE SIZE

- **초산돈 48두**
  48 crossbred pregnant gilts [(Yorkshire x Landrace) x Duroc]
- **무작위 배치**
  Randomly allocated to the treatments:
  - 1. 대조구 사료 Control diet
  - 2. 실험구 사료(대조구 사료+ SWF 4kg/톤) Control diet + 0.4% SWF

SWF 4kg을 기존 탄산칼슘 4kg 맞대체
SWF was formulated into the diet, replacing limestone.

Study published by Upadhaya et al. (2022a and 2022b)

실험 결과 KEY FINDINGS

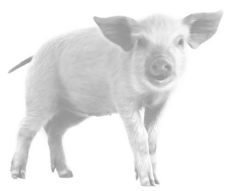
- **복당 실산자수 0.75두 증가**
  0.75 extra piglet per sow born alive
- **PSY 1.05 증가** extra piglet per sow weaned
- **분만시간 25분 단축**
  Shorter farrowing duration of 25 minutes
- **분만 전후 모돈의 염증 지표 감소 및 스트레스 완화**
  Reduced markers of inflammation and stress levels in sows around farrowing
- **인슐린 저항성 감소** Improved insulin resistance

실험 측정 항목 AS MEASURED BY

- **복당 산자수 및 이유두수**
  Litter performance at birth and weaning
- **태반과 탯줄을 통한 글루코스 수송과 인슐린 저항성**
  Glucose transporters and insulin resistance in placenta and umbilical cord
- **염증 관련 스트레스 지표**
  Stress parameters linked to inflammation
- **모돈 혈중 칼슘 마그네슘 수준**
  Ca and Mg status in sows
- **모돈 번식성적** Sow performance

1 **0.3kg**
이유 시 자돈 0.3kg 증체
extra body weight per piglet at weaning

추가 이유두수 증가
Extra piglet weaned



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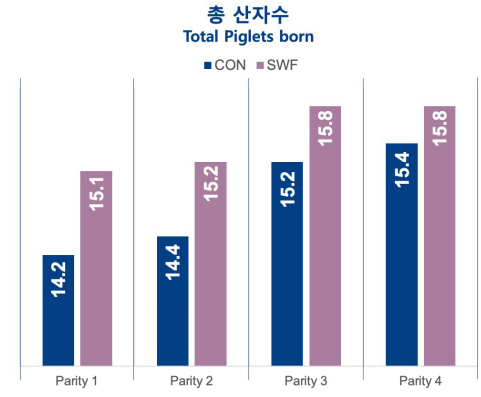
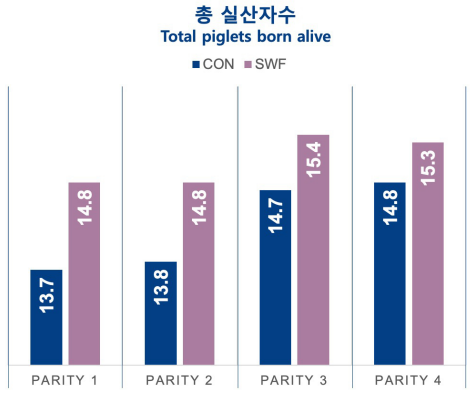
급여 효과 Impact in use | South Korea 2022 | Trial at a glance

SWF 급여 효과 : 총 산자수 0.7두, 총 실산자수 0.75두 증가

SWF increases total number of piglets born with 0.7 piglets. Total piglets born alive is increased with 0.75 piglets.



Parity P <0.001
Treatment P <0.001



Parity P <0.001
Treatment P <0.001

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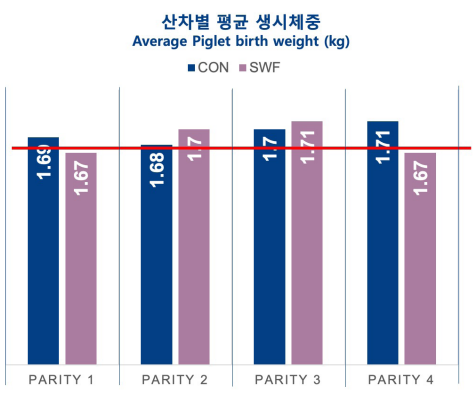
SWF 급여 효과 Impact in use | South Korea 2022 | Trial results

SWF 급여는 자돈 생시체중 영향 없으나, 이유체중 두당 0.35kg 증가 효과

Piglet birth weight is not affected, but piglet weaning weight is increased with 0.35 kg per piglet.

분만사에서 입질사료 급여하지 않음 Piglets did not receive creep feed.



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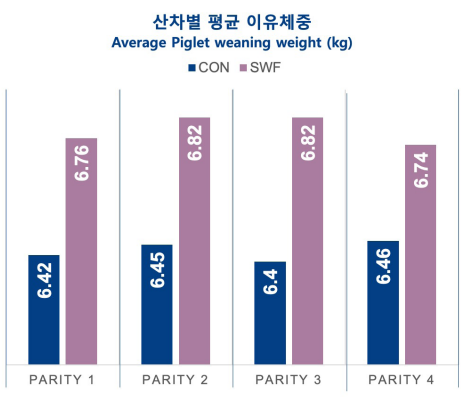

Treatment P <0.001

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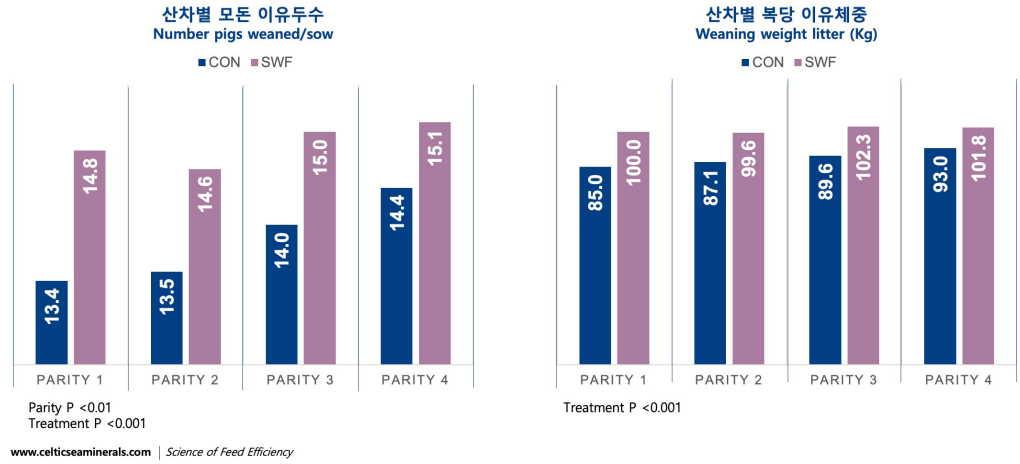
SWF 급여 효과 Impact in use | South Korea 2022 | Trial results

SWF 급여 결과 모돈의 복당 이유두수 1.05두 증가, 복당 이유체중 12kg 증가
SWF fed sows weaned 1.05 piglets extra per litter, resulting in 12 kg extra weaning weight per litter.



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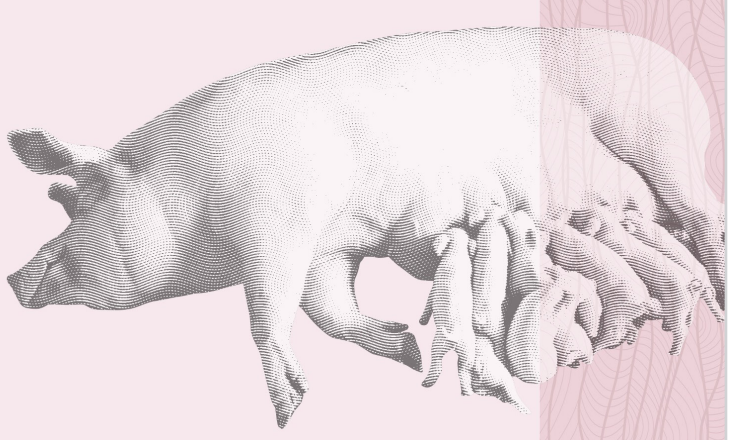
4. 작용기전 How it works

1. **체조직 내 염증 감소**
   Reduce systemic inflammation.
2. **글루코스 대사 향상**
   Improve glucose metabolism.
3. **장기 조직의 기능 향상**
   Increase tissue functioning.



세 가지 복합 기전 Triple mode of action.

SWF는 항염 작용하는 생리활성물질과 해조 미네랄 복합물
A seaweed formulation containing anti-inflammatory bioactives and marine minerals.

1 염증 감소 REDUCING INFLAMMATION

면역기능 최적화
Optimize immune functioning
(체내 염증 감소 및 장누수증후군 감소
Reduced systemic inflammation and reduce leaky gut.)

2 글루코스 대사 향상 IMPROVE GLUCOSE METABOLISM

인슐린 저항성 감소, 탯줄을 통한 자궁과 태아에 글루코스 공급 향상되며 전체적인 글루코스 공급이 정상화됨.
Reduce insulin resistance,Improving glucose uptake in umbilical cord and placenta and improving overall glucose tolerance.

3 조직 기능 향상 INCREASE TISSUE FUNCTIONING

근육 수축작용 향상
Improving muscle functioning
자궁근육 기능 강화로 분만시간 단축 및 자궁탈출증 감소
Enhance tissue functioning to reduce farrowing time and pelvic organ prolapses.

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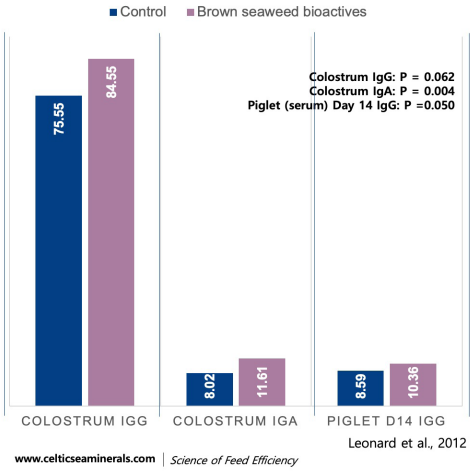
염증 감소 reducing inflammation

1. 자돈의 면역 구동 Immune modulation in offspring.



Leonard et al., 2012

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SWF는 강력한 면역 구동작용으로 자돈에 영향을 줌
SWF has been shown to be a strong immune modulator and carries this effect onto the offspring:

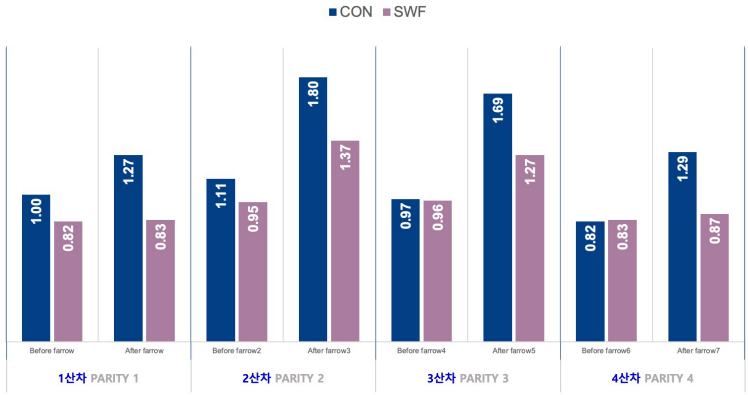
- **양질의 초유 섭취로 자돈 면역체계 확보**
  It primes the immune system of the piglet through improved colostrum quality
  (Leonard et al., 2012; Heim et al., 2014)
  - **고농도의 면역글로불린 섭취로 신속한 방어기전 확보**
    Colostrum contains high levels of Immunoglobulins to provide immediate immune protection
- **자돈의 성장에 따라 방어기전을 유지함**
  Defend the piglet to challenges later in life
  - **이유 시 대장균, 살모넬라 공격으로부터 염증 예방 및 신속한 회복력 구축**
    Like weaning, *E. coli* or *S. Typhimurium*. Reduced inflammatory response, less pathogenic bacterial colonization and shedding, faster recovery.
    (Bouwhuis et al., 2016, Bouwhuis et al., 2017;
    Heim et al., 2014)

염증 감소 reducing inflammation

1. SWF의 항염작용 SWF works as an anti-inflammatory

- **코티솔은 염증 발현 대사산물**
  Cortisol is a pro-inflammatory metabolite.
- **모돈의 코티솔 감소는 항염작용 및 보다 편안한 상태 유지**
  Reduced cortisol levels are anti-inflammatory and are also associated with more relaxed sows.
- **혈액 내 아드레날린 호르몬 측정 결과 평온한 상태를 유지**
  Noradrenaline and adrenaline levels (*flight and fright*) were measured in blood, which showed the same pattern: reduced when **SWF** was fed.

산차별 코티솔 변화 Cortisol levels are reduced across parities



Before Farrow: Parity P <0.001
After Farrow: Parity P <0.001, Treatment P <0.001

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글루코스 대사 향상 improve glucose metabolism

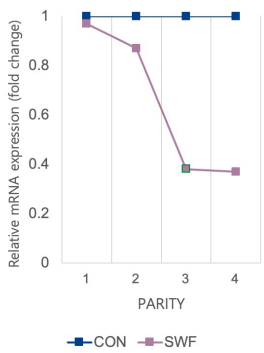
2. 임신돈 대사증후군 Metabolic syndrome during gestation – SWF prevents negative impact on piglets

- **임신돈 당뇨 증상 완화로 자돈 영양 공급**
  SWF prevented the negative effects of metabolic syndrome and gestational diabetes being passed onto the piglets.
- **인슐린 저항성 지표 2.5배 감소**
  The SCD gene is involved in fat metabolism: a high level of this gene favours fat deposition.
- **지방 축적 감소 및 인슐린 저항성 완화**
  Thus, a reduced expression of the SCD gene means less fat deposition and subsequent less insulin resistance.
- **경산차 모돈의 태아에 글루코스 공급 향상**
  The increased glucose transporter also confirms this reduced insulin resistance, since there is more glucose being delivered to the piglets.

García-Serrano et al., 2010; Cheng et al., 2019; Cheng et al., 2018

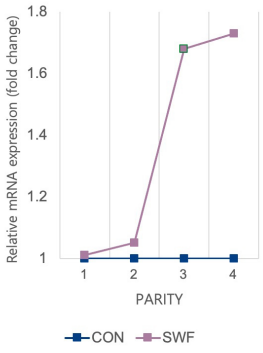
2.5-fold reduction

Insulin resistance marker (SCD) umbilical cord



1.8-fold increase

Glucose transporter (SCL2A2) umbilical cord

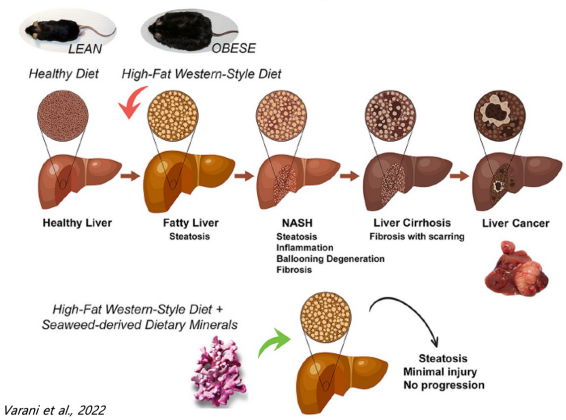


Upadhaya et al., 2022

글루코스 대사 향상 improve glucose metabolism

2. 간 병변 감소 SWF reduces liver damage

Liver injury and progression in mice on a Western-Style diet: Effects of dietary minerals



Varani et al., 2022

- **16주간 비만 촉진 고지방 사료 급여 시 대조구 급여구 비급여구**
  Mice prone to obesity were fed a high fat diet for 16 weeks, with or without **SWF**.
- **대조구는 정상 쥐** Normal mice were kept as control.
- **16주 후 SWF 급여 후 지방간 증상 쥐는 지방구가 사라지고 지방간 회복**
  After 16 weeks, a fatty liver and clear steatosis ("ballooning") was seen in the high fat diet treatment group.
- **SWF 급여는 지방대사를 억제하고 탄수화물 대사 활성화로 회복됨**
  This was substantially reduced in the SWF fed group, together with molecular changes in genes associated with dysregulated fat and carbohydrate metabolism.
- **본 연구 결과 고에너지 사료 급여 기간 관계없이 대사장애 예방 효과**
  SWF could prevent the adverse, downstream effects activated by the high-fat diet in both the short (this study) and long-term (Aslam et al., 2012; Aslam et al., 2016).

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물질별 조직 기능 향상 increase tissue functioning

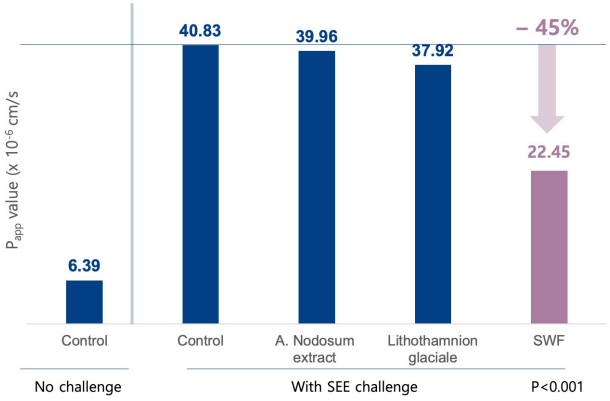
실험모델 : 네덜란드 TNO 인공장기 실험
InTESTine model at TNO, the Netherlands

3. 면역 향상으로 장관벽 강력한 방어 구축 Boosting immunity with a strong gut barrier.

- **장관벽 보호기능 평가 모델**
  Ex vivo model for assessing the gut barrier.
- **세포 내 살모넬라 접종**
  Tissue was also challenged with *Salmonella enterica enteritidis*.
- **장벽 침윤 8배 급증**
  The challenge worked: permeability of the gut barrier increased 8-fold following the SEE challenge.
- **장벽 보호기능은 처리구에 영향 받음**
  Gut barrier was affected by treatments.
- **SWF구 강력한 장보호 기능으로 감염도 낮춤**
  Reduction in P_{app} value means that the gut barrier is stronger.

Synergistic effect between *A. Nodosum* extract and *Lithothamnion glaciale*: very positive effect on barrier function.

SWF 장누수증후군 감소 효과
Reduction in leaky gut following SEE challenge with SWF



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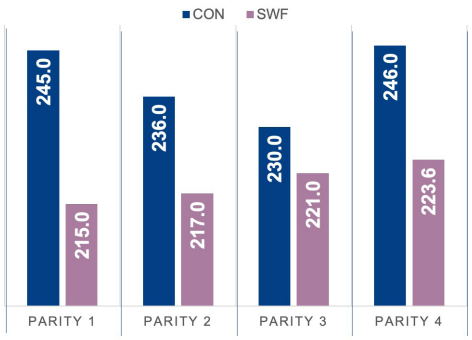
물질별 조직 기능 향상 increase tissue functioning

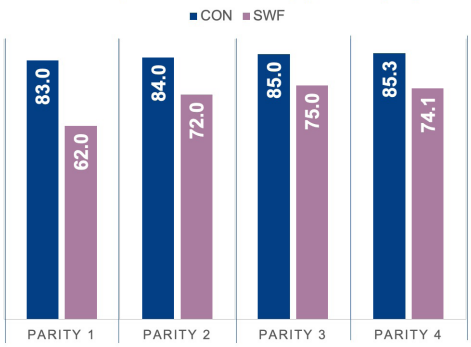
3. SWF의 분만시간 20분 단축 효과 SWF resulted in the farrowing time being reduced by 20 minutes

분만시간(첫 분만~최종 분만/단위 분)
Farrow duration between first to last piglet born (Min)



Parity P <0.1
Treatment P <0.001

최종 분만 후 후산 배출시간
Placenta expulsion time after last piglet birth (Min)



Parity P <0.01
Treatment P <0.001

Upadhaya et al., 2022

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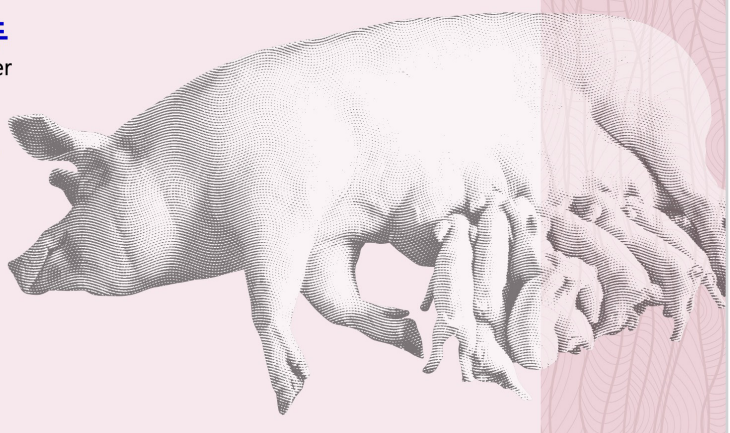
5. 요약 In summary

- **SWF 급여 모돈의 PSY + 1.6두**
  SWF fed sows wean 1.6 extra piglets per year
- **권장량 임신돈 및 포유돈 사료 톤당 4kg**
  Include SWF at 4 kg/tonne in both gestation and lactation diets



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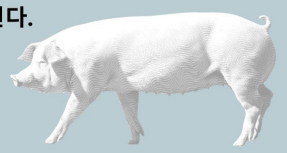
연구 결과 Conclusions from research

- **모돈 생산성 향상은 여러 가지 요소가 작용한다.**
  improve sow output and health, multiple factors play a role.
- **출생 시 활력과 초유를 잘 섭취하는 것은 PSY 향상의 필수요소다.**
  Birthing vital, thriving piglets is essential for a good number of PSY.
- **모돈이 체내 글루코스 흡수를 향상시키는 것이 순산과 건강한 자돈을 분만함으로써 모돈이 건강해진다.**
  Improving the glucose distribution within the sow allows for a smoother farrowing process while improving piglet vitality and sow health.
- **임신돈의 인슐린 저항성은 일반적인 현상이나 일반적으로 인식되고 있지는 않다.**
  Insulin resistance during pregnancy is common in sows but is not generally recognized.
- **따라서 모돈의 인슐린 저항성을 줄여줌으로써 모돈 도태가 감소하고 PSY도 향상된다.**
  Hence, reducing insulin resistance will help to reduce sow losses and improve PSY.



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A unique seaweed formulation with anti-inflammatory bioactives and marine minerals can help to tackle insulin resistance and improve sow productivity

Improves sow productivity by:

- ✓ **Reduce inflammation.**
- ✓ **Improve glucose metabolism.**
- ✓ **Increase tissue functioning.**

Wean up to
1.6
piglet extra per sow.

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단국대학교 임신돈 사료배합비 Gestation diets Dankook

Ingredient composition of experimental gestation diets[1] (%, as-fed basis)

Items	Gestation		
	CON	CM1	CM2
Corn	49.02	48.93	49.33
Soybean meal (48%)	4.22	4.25	4.06
Soybean oil	2.06	2.1	1.89
Dehulled Soybean meal	5.94	5.94	5.94
Palm kernel meal	2	1.94	2.3
Wheat	24.41	24.41	24.41
Wheat bran	3.3	3.3	3.33
Soybean hull	2.2	2.2	2.2
Molasses	3.25	3.25	3.25
MCP	0.8	0.8	0.8
Salt	0.5	0.5	0.5
Methionine (99%)	0.01	0.01	0.01
Threonine (100%)	0.09	0.09	0.09
L-lysine (78%)	0.23	0.23	0.24
Vitamin / Mineral premix[2]	0.4	0.4	0.4
Choline (25%)	0.15	0.15	0.15
Phytase	0.01	0.01	0.01
Limestone	**1.39**	**1.09**	**0.69**
MgO	**0.02**	-	-
SWF	-	**0.4**	**0.4**

Calculated composition	CON	CM1	CM2
ME, kcal/kg	3,200	3,200	3,200
Analyzed composition			
DM	88.5	89.1	88.6
CP	12.8	13.0	12.9
Fat	4.4	4.44	4.24
Ca	**0.77**	**0.77**	**0.62**
P	0.5	0.49	0.5
Mg	**0.19**	**0.19**	**0.19**
Lys	0.70	0.70	0.70
Met	0.21	0.20	0.21

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단국대학교 포유돈 사료배합비 Lactation diets Dankook

Ingredient composition of experimental lactation diets1 (as-fed basis, %)

Items	Lactation		
	CON	CM1	CM2
Corn	41.08	40.94	41.19
Soybean meal (48%)	4.02	4.03	3.96
Soybean oil	3.21	3.26	3.08
Dehulled Soybean meal	12.96	12.96	12.96
Wheat	23.00	23.00	23.00
Wheat bran	8.31	8.31	8.31
Soybean hull	2.00	2.00	2.0
Molasses	2.00	2.00	2.4
MCP	0.59	0.59	0.59
Salt	0.5	0.5	0.5
Threonine (100%)	0.05	0.05	0.05
L-lysine (78%)	0.3	0.3	0.3
Vitamin / Mineral premix[2]	0.4	0.4	0.4
Choline (25%)	0.12	0.12	0.12
Phytase	0.01	0.01	0.01
Limestone	1.43	1.13	0.73
MgO	0.02	-	-
SWF	-	**0.4**	**0.4**

Calculated composition	CON	CM1	CM2
ME, kcal/kg	3,300	3,300	3,300
Analyzed composition			
DM	88.8	88.1	89.0
CP	16.3	16.5	16.4
Fat	5.76	5.81	5.64
Ca	**0.74**	**0.75**	**0.60**
P	0.51	0.53	0.56
Mg	**0.25**	**0.25**	**0.25**
Lys	0.92	0.90	0.89
Met	0.20	0.23	0.21

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MEMO