The Application of Low Soybean Meal Diet Technology for Sows

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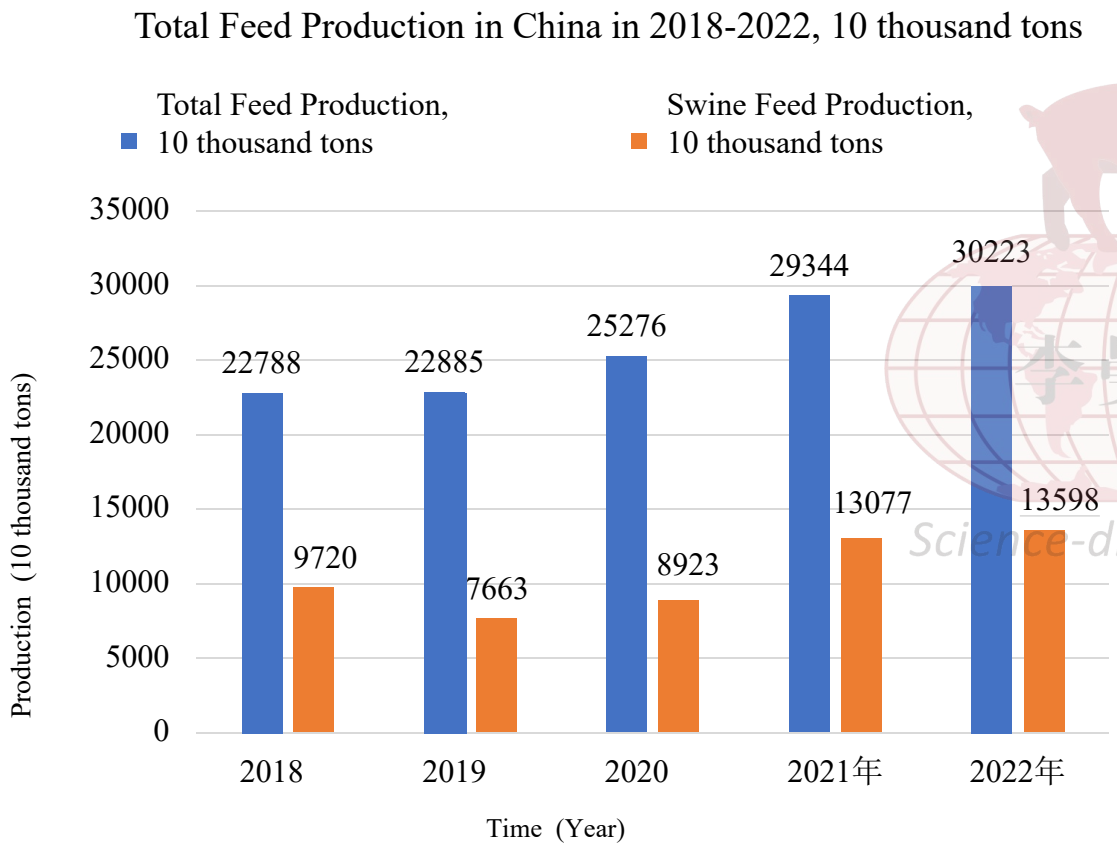
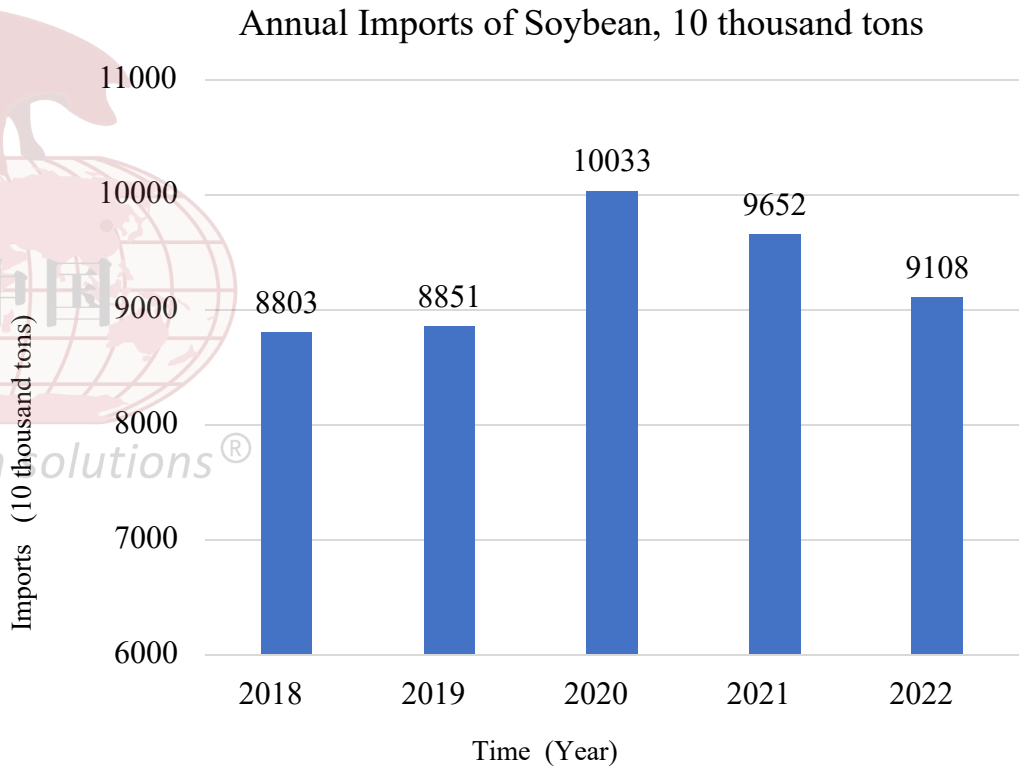
I. Background

1.1 Domestic Demand for Soybean Meal



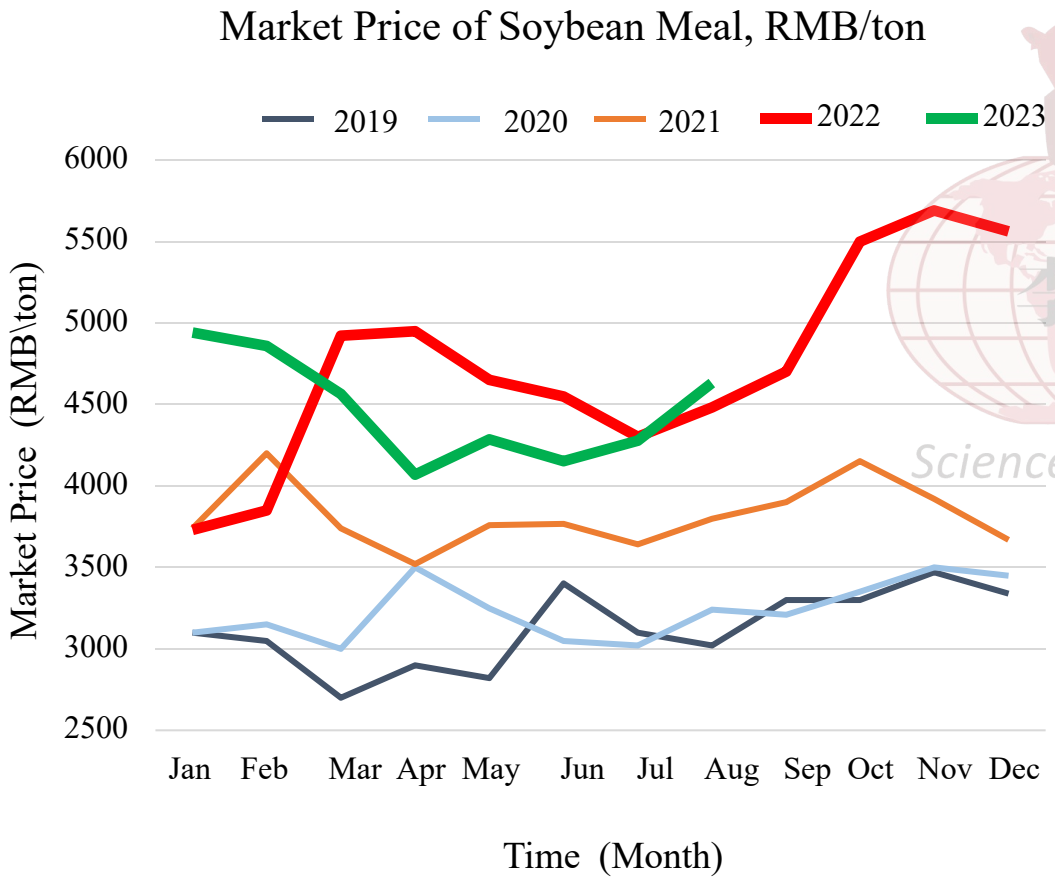
(Data source: China Feed Industry Association)

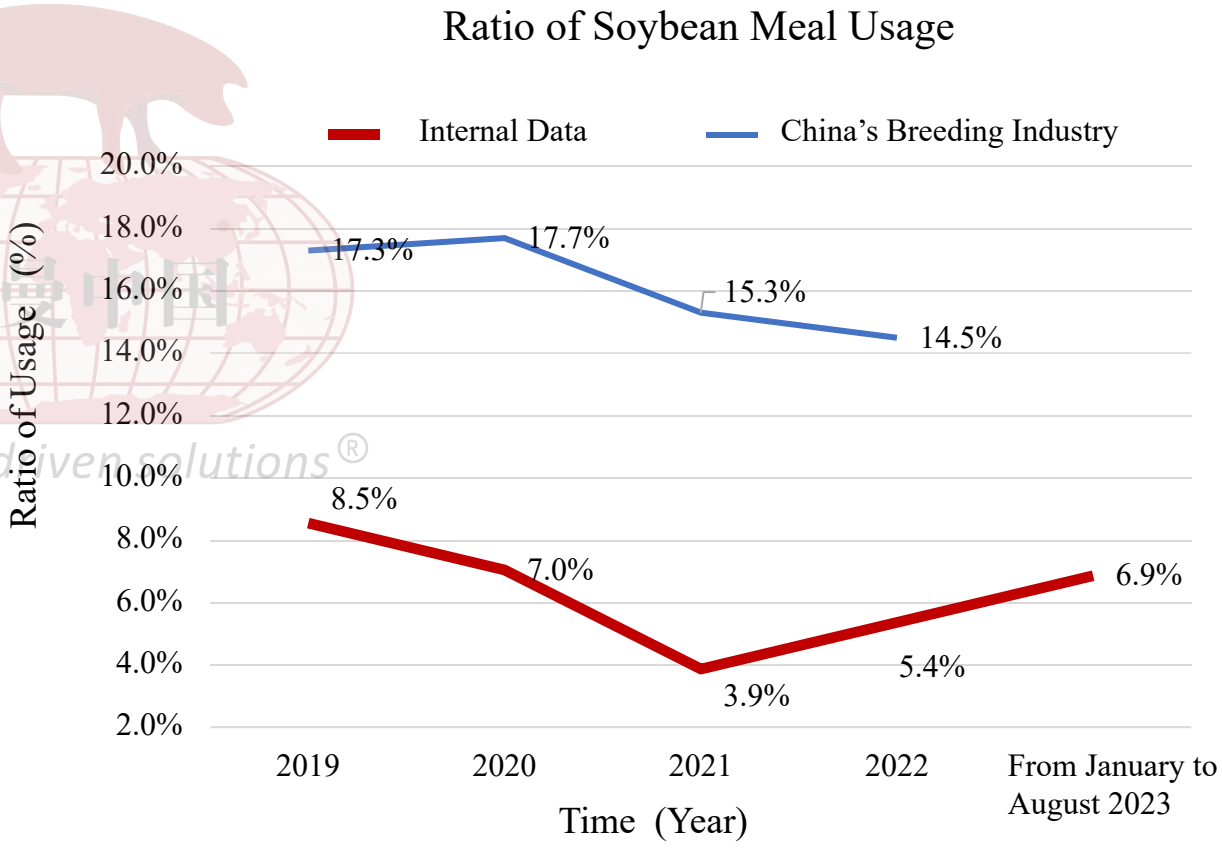


(Data source: The General Administration of Customs)

I. Background

1.1 Domestic Demand for Soybean Meal





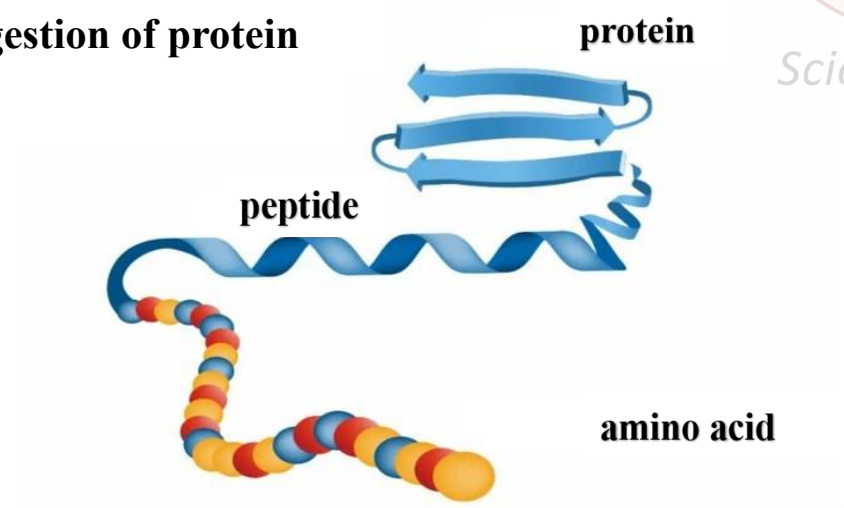
(Data source: China Feed Industry Association & Internal data)

I. Background

1.2 Summary of low soybean meal diets

- Low-protein diets are one of the main measures to reduce soybean meal usage.
- Protein nutrition is mainly amino acid nutrition. The protein level needs to be appropriately reduced by (1~4 %) and industrial synthetic amino acids should be supplemented. Thus, achieving amino acid balance has no significant impact on animal growth performance.
- The seven amino acids added include lysine, methionine, threonine, tryptophan, arginine, valine, isoleucine (their industrial production have been achieved) .

The digestion of protein



Amino Acid Barrel Theory

I. Background

1.2 Overview of Low Soybean Meal Diets

The Usage Limit of Soybean Meals in Compound Feed for Pigs at Different Stages

Items	Compound Feed for Piglets		Compound Feed for growing-finishing pigs				Compound Feed for Sows	
	3-10 kg	10-25 kg	25-50 kg	50-75 kg	75-100 kg	100kg-slaughter weight	Gestating sows	Lactating sows
Soybean Meal Usage, %	≤15	≤16	≤13	≤10	≤8	≤5	≤8	≤16
Crude Protein Level, %	17.0-20.0	15.0-18.0	14.0-16.0	13.0-15.5	11.0-14.0	10.0-13.0	≤90 days：9.5-13.5 >90 days：11.0-16.0	16.0-18.0

(Source: Technical Specifications for Diversified Diet Production of Low Protein and Low Soybean Meals for Pigs)

I. Background

1.3 Specific implementation Direction of low soybean meal diets

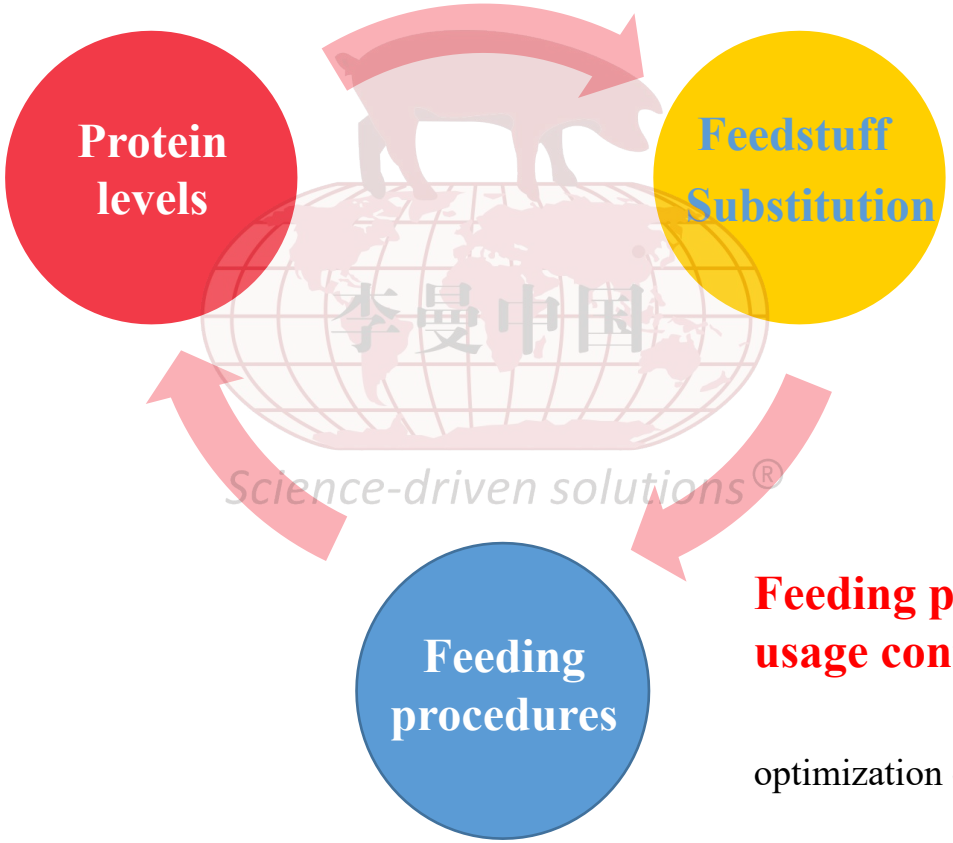
Protein Levels

low protein level

balanced amino acids

Additive amount of crystalline Amino Acid

(Pay attention to the balance of non-essential and essential amino acids)



Feedstuff Substitution

miscellaneous meals (treatment of anti-nutritional factors)

by-products

wheat

Feeding procedures: absolute usage control of soybean meal

optimization of feeding procedures

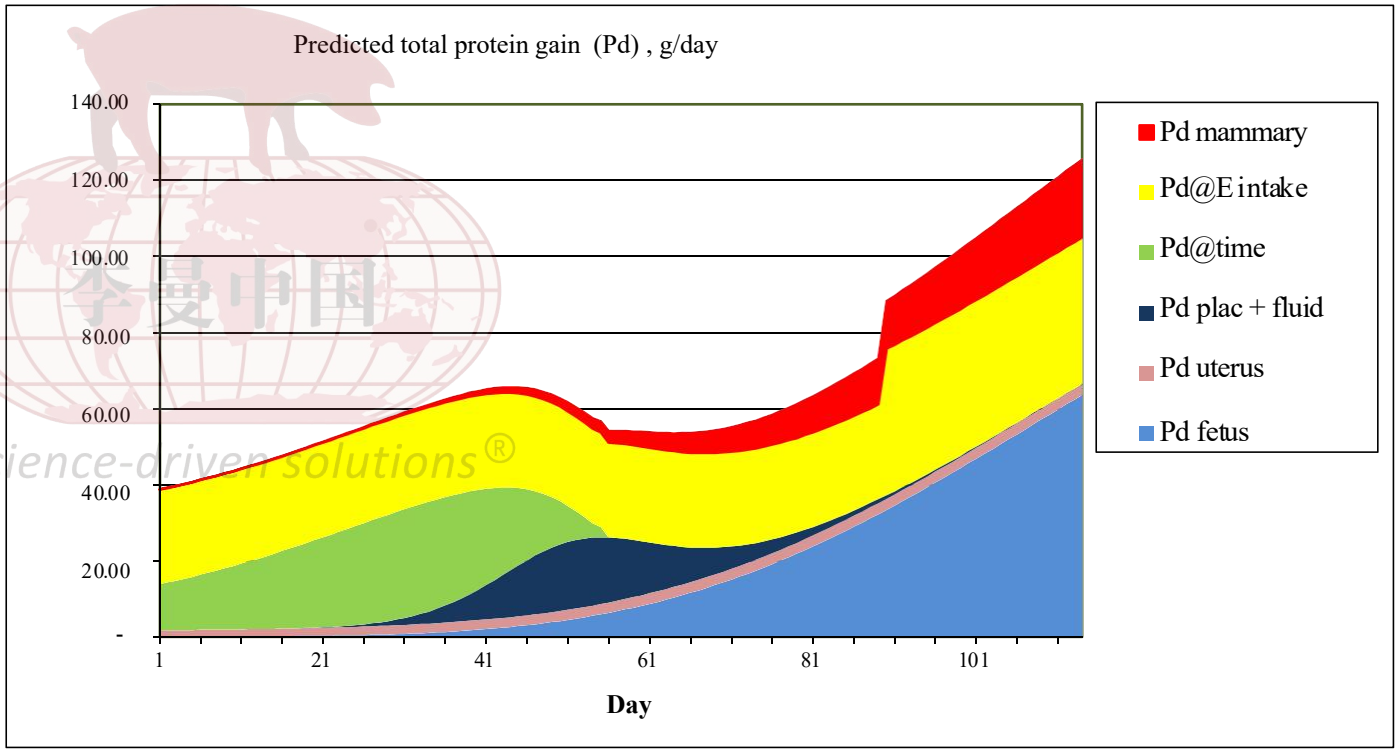
feeding management

II. Low-protein Diets

2.1 Gestating Sows

- ✓ Total requirements for gestation = requirements for maintenance+maternal weight gain+gestational weight gain
- ✓ Different feeding programs, parity and expected total litter size will affect the needs of gestating sows.
- ✓ Nutritional design goals for gestation: maternal weight gain (breast tissue and body fat stores) meets expected goals, and gestational growth is not restricted

Protein deposition during gestation of sows



Gestation days

II. Low-protein Diets

2.1 Gestating Sows

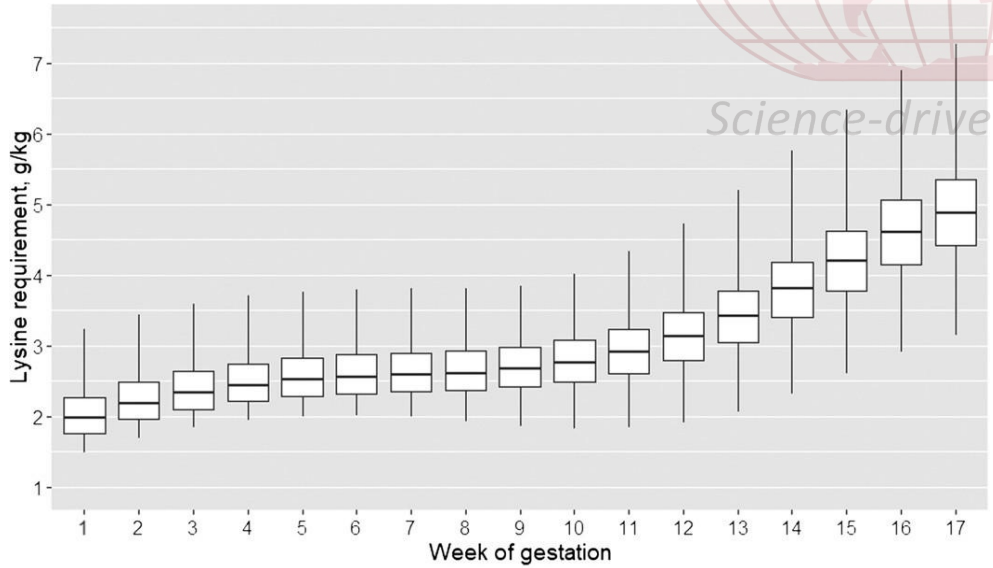
Progess of Domestic and International Research on Low-protein in Gestating Sows

References National Research Progress	Changes in dietary protein levels	**SID Lys Levels**	Feeding amount during gestation	Balanced Amino Acid Measures	Sows	Conclusions
Kim et al, 2023	11%, 12%, 13%, 14%, 15%, 16%,	0.82%	2.4 kg/d	lysine, methionine, threonine, tryptophan	Full gestation period in multiparous sows	No significant impact on sow farrowing performance and piglets' growth performance
Kroeske et al, 2021	168 vs 122 g CP/ kg	65 g/kg	2.6 kg/d	lysine, methionine or cystine, threonine	The last 5 weeks of gestation for sows with 1-8 parities	No significant impact on sows' body condition and farrowing performance, and piglets' birth weight and weaning weight.
Yang et al, 2022	13.3% vs 10.2% CP	0.68%	2.4 kg/d	lysine, methionine or cystine, threonine, tryptophan	Full gestation period in multiparous sows	No significant impact on total litters' size and live litter size, piglets' birth weight, and sows' weight
Fang et al, 2019	10.5, 12, 13.5% CP	0.67%	2.4 kg/d	lysine, methionine, threonine, tryptophan	Full gestation period in multiparous sows sows	10.5% of sows in the treatment group showed a significant increase in backfat loss during the lactation phase and 12% of piglets in the treatment group showed a significant increase in piglet weight gain
Scholars including CUI Jia jun, 2016	10.5, 12.5, 14.5% CP	0.66%	<20 days：2.0 kg/d 20-90 days：2.5 kg/d >90 days：3.5-4 kg/d	lysine, methionine or cystine, threonine, tryptophan	Full gestation period (unspecified parity)	No significant impact on total litters' size and live litter size, piglets' birth weight, and sows' weight

II. Low-protein Diets

2.1 Gestating Sows-Lys Requirement

- The graph below represents the daily feed intake of 2.60 kg (13 MJ ME/kg) for sows during gestation and SID lysine requirement in the diet for each week of gestation
- From breeding to week 10 , SID Lys in the diet increased from 2.2 to 3.0 g/kg (5.7-7.8 SID Lys g/d) to meet the need of 75% sows, and increased from 2.0 to 2.7 g/kg (5.2-7.0 SID Lys g/d) to meet the need of 50% sow.
- From week 10 to the end of gestating period, SID Lys in the diet increased from 3.0 to 5.4 g/kg (7.8-14.0 SID Lys g/d) to meet the need of 75% sows, and increased from 2.7 to 4.9 g/kg (7.0-12.7 SID Lys g/d) to meet the need of 50% of sows.



SID AA	SID AA：SID Lys ratio	SID AA	SID AA：SID Lys ratio
lysine	100	lysine	100
methionine	27.1	leucine	102.6
methionine+cysteine	66.4	isoleucine	64.8
tryptophan	21.2	valine	78.6
threonine	74	histidine	32.6
phenylalanine	61.5	arginine	42.9
phenylalanine+tyrosine	102		

(Gaillard et al, 2023)

II. Low-protein Diets

2.1 Gestating Sows-Lys Requirement

SID lysine recommended by different nutritional standards needs to be compared with the results of this study

1.NRC (2012) recommends that SID lysine levels should meet the requirements of almost all primiparous sows and multiparous sows at all stages.

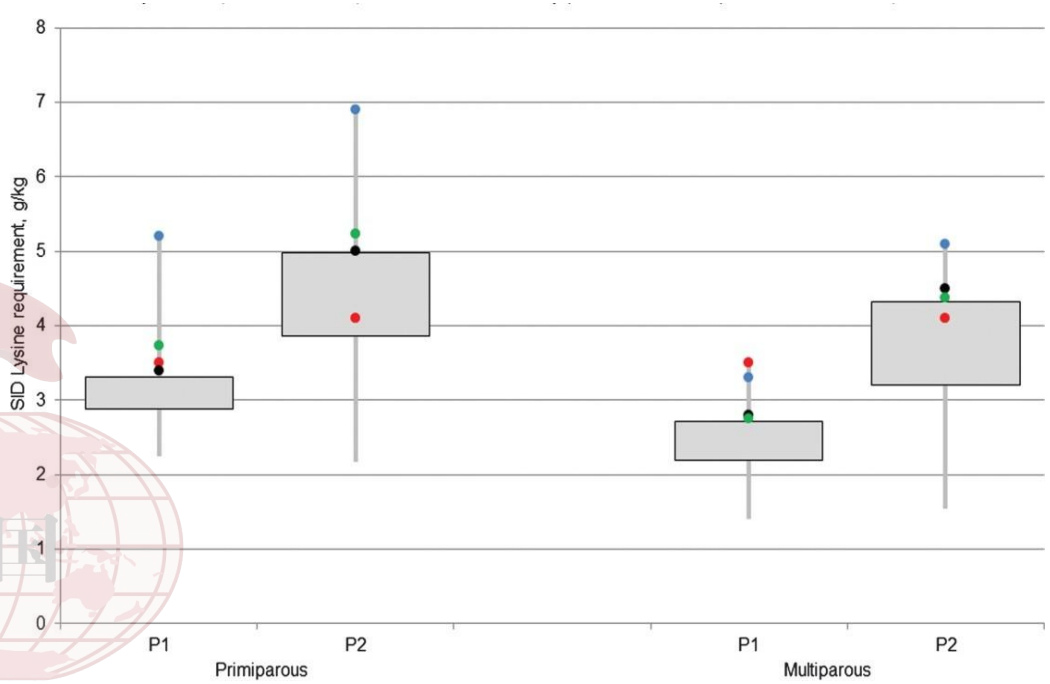
2. Undivided parity in **Danish pig nutrition recommendations**:

- For the first parity, recommended SID lysine levels can meet the requirements of 95% sows in the early gestation period and the requirements of 26% sows in the late gestation period.
- For the multiparous sows, recommended SID lysine levels can meet all the requirements of sows in the early gestation period and the requirements of the first 74% sows in the late gestation period.

3. InraPorc models:

- For the first parity, recommended SID lysine levels can meet all the requirements of sows in the early gestation period and the requirements of 98% sows in the late gestation period
- For the multiparous sows, recommended SID lysine levels can meet 82% of the requirements of sows in the early gestation period and the requirements of the first 88% of sows in the late gestation period.

The main reason for the significant variation in the recommendations of various nutritional standards is the difference in the assumed values of SID lysine efficacy, the requirements of the sow and the fetus, and the requirements for lysine also depends on the feeding amount during gestation.



Boxplot of recommended SID lysine requirements per kg of diet for gestating sows by parity (first litter sows/multiparous sows) and gestation stage (early stage/ late stage) .

- NRC nutrition recommendation
- Danish nutrition recommendation for pigs (Tybirk. 2015)
- InraPorc models in nutrition recommendation (Dourmad, 2008) This research meets the recommended nutrient intake of 90% sows

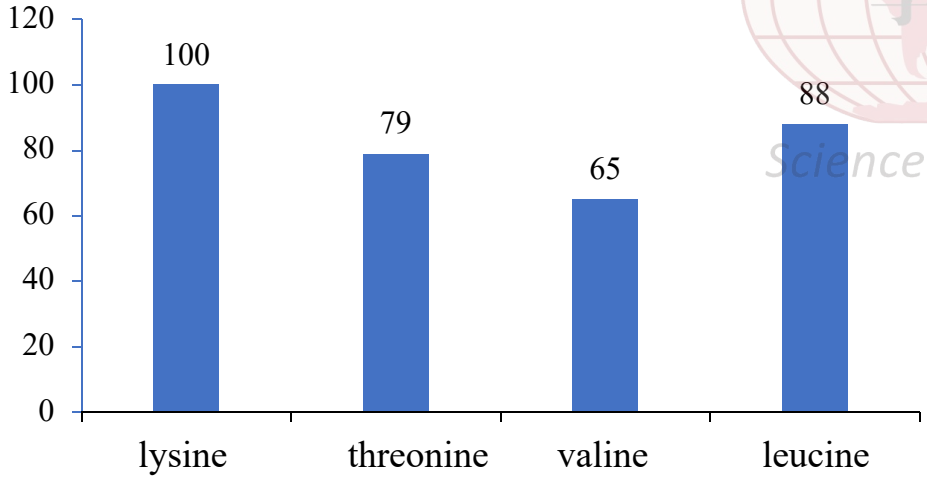
(Gaillard et al, 2023)

II. Low-protein Diets

2.1 Gestating Sows-Balanced Amino Acids

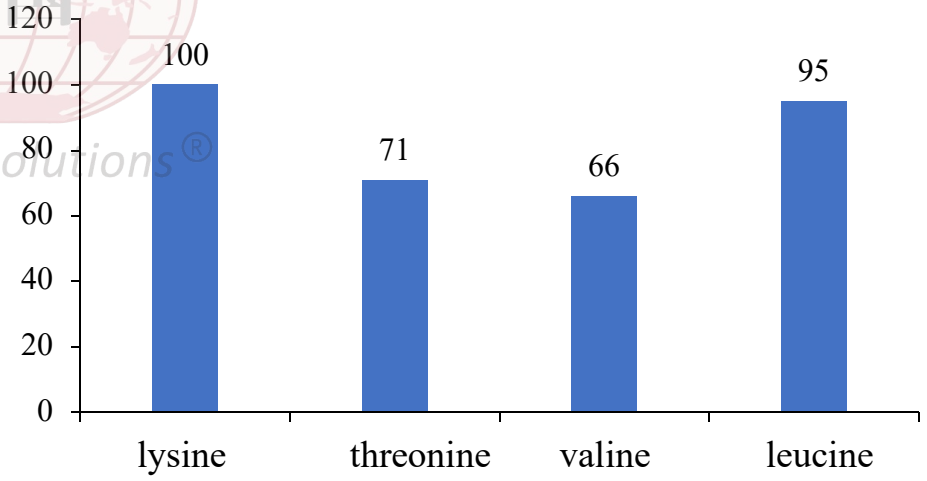
- Sow amino acid requirements and optimal ratio change dynamically with gestational stages
- It is recommended that on days 0 ~ 60 and 60 ~ 114 of gestation, the daily requirements of SID Lys are 5.57 and 8.78 g, respectively. The relative optimal ratio of lysine:threonine:valine:leucine (based on AA weight) is 100:79:65:88 and 100:71:66:95, respectively.

gestation period: 0-60 days



SID Lys requirement is 5.57 g/d

gestation period: 60-114 days



SID Lys requirement is 8.78 g/d

(Kim et al, 2009)

II. Low-protein Diets

2.1 Gestating Sows-Balanced Amino Acids

Ratio of SID amino acid balance in diets for gestating sows with different nutritional standards

	PIC, 2022	CVB, 2020	Salvadoran system, 2022	NRC, 2012		Nutritional requirements of pigs in China, 2020		Nutritional Requirements of Pigs and Poultry in Brazil, 2017	
				<90 days	>90 days	<90 days	>90 days	0-85 days	86-114 days
Standard ileal digestible amino acid basis									
lysine	100	100	100	100	100	100	100	100	100
methionine	-	-	31	28	28	28	28	34	35
methionine+cysteine	70	68	65	70	68	68	68	68	70
threonine	76	75	72	80	74	77	73	77	80
tryptophan	19	19	20	20	21	19	20	20	20
valine	71	78	74	76	73	75	73	73	77
isoleucine	58	65	60	59	52	58	52	60	58
leucine	92	102	102	94	96	92	95	90	95
histidine	35	32	35	34	30	34	31	35	34
phenylalanine	-	61	58	58	57	57	57	55	56
phenylalanine+tyrosine	96	-	102	100	97	98	97	100	102

II Low-protein Diets

2.2 Lactating Sows

Advances of Domestic and International Research on Low-protein in Lactating Sows

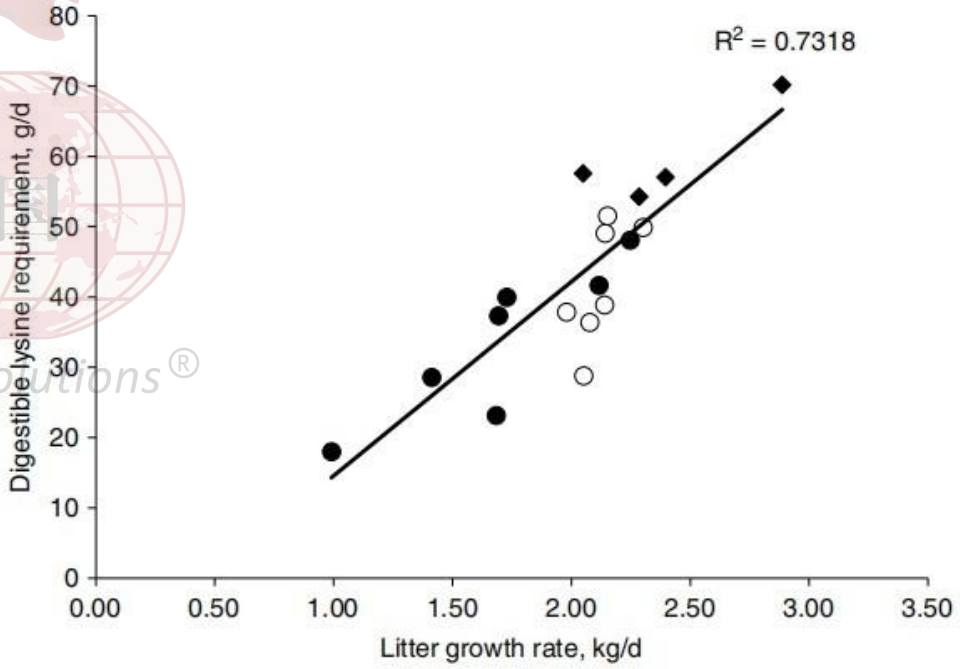
References National Research Progress	Changes in protein levels of Diets	**SID Lys Levels**	Range of feed intake during lactation	Balanced Amino Acid Measures	Sows	Conclusions
Pedersen et al., 2018	11.8, 12.8, 13.4, 14.0, 14.7 and 15.6% SID CP	0.95%	2-28 days: 6.17-6.53 kg/d	lysine, methionine, threonine, tryptophan	primiparous /multiparous sows	13.4% SID CP significantly increased piglet daily weight gain 11.8, 13.4, 15.6% SID CP significantly increased sow feed intake
Huber et al., 2015	12.43% VS 12.43% CP	0.74 vs 0.93%	1-22 days: 6.12 vs 6.00 kg/d	lysine, isoleucine, methionine/cystine, threonine, arginine, histidine, leucine, phenylalanine/tyrosine	multiparous sows	There were no significant differences in sow feed intake and piglet growth performance
Huber et al., 2015	16.0%, 15.7%, 14.3% and 13.2% CP	0.74%	1-21days: 5.48-5.76 kg/d	lysine, methionine or cystine, threonine, tryptophan	multiparous sows	There were no significant differences in average daily feed intake of sows and daily weight gain of piglets among treatments.
Strathe et al., 2017	104.3, 113.3, 120.9, 128.5, 139.2 or 150.0 g/kg CP	5.8, 6.5, 7.0, 7.5, 8.3, 9.0 g/kg	1-25 days: 6.28-6.44 kg/d	lysine, methionine or cystine, threonine, tryptophan, valine, leucine, isoleucine, phenylalanine, histidine	Sows with 1-4 parity	Increasing the SID CP to 135 g/kg or 850 g/d increases daily piglet weight gain due to increased milk yield and daily protein production in milk.
DONG Zhiyan et al., 2013	18, 17, 16, 15% CP	0.87%	1-21 days: 5.29-5.46 kg/d	lysine, methionine or cystine, threonine, tryptophan, valine	multiparous sows	There were no significant differences in sow feed intake during lactation, weight loss, weaning to estrus interval, litter weight gain and daily weight gain of piglets during lactation.

II. Low-protein Diets

2.2 Lactating Sows -SID Lys Requirements

- SID Lys requirement for lactating sows is determined by daily litter weight gain of suckling piglets

- Based on an analysis of published studies on primiparous and multiparous sows between 1998 and 2017 (diamond shaped box) , the digestible lysine intake required per 1 kg litter weight gain would increase to 27 g per day, and the expected mobilization of lysine from the body's protein reserves would also increase to 13 g per day (see right-hand chart)



(Tokach et al, 2019)

II. Low-protein Diets

2.2 Lactating Sows -SID Lys Requirements

- SID Lys requirements for lactating sows under different litter weight conditions

Figure 12: Dietary amino acid levels based on piglet growth rate and feed intake of lactating sows (%) [a]

Piglet growth rate, kg/d	Average feed intake, kg/d					SID lysine intake, g/d
	4.5	5.0	5.4	5.9	6.4	
2.0	0.96	0.87	0.80	0.74	0.68	43.3
2.3	1.09	0.99	0.91	0.84	0.78	49.6
2.5	1.23	1.12	1.03	0.95	0.88	55.9
2.7	1.37[b]	1.25	1.14	1.05	0.98	62.1

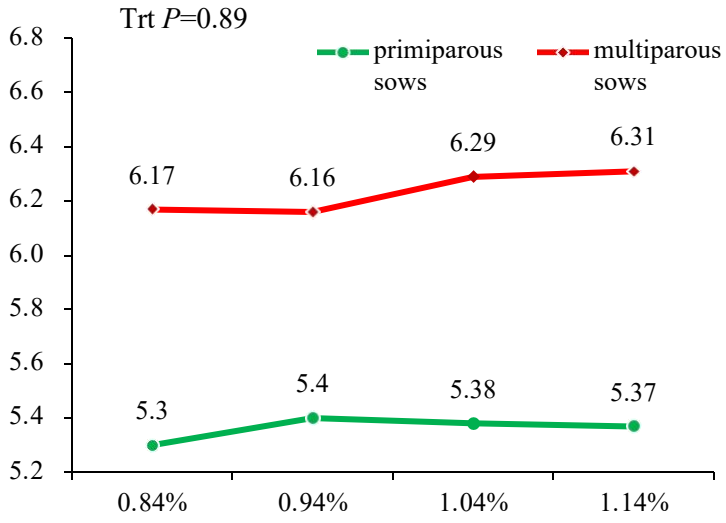
PIC version, 2021

II. Low-protein Diets

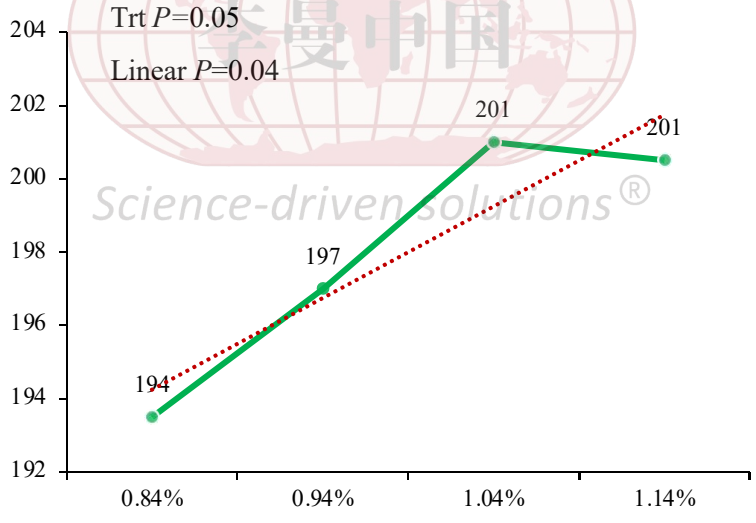
2.2 Lactating Sows -SID Lys Requirements

- The SID Lys experiment was set up in four gradient treatments: 0.84, 0.94, 1.04, and 1.14%, and 40 primiparous sows in each treatment were kept track of consecutively for two breeding cycles. It was found out that the average daily gain of piglets and weight of piglets at day 21 increased linearly with the increase of SID Lys level.

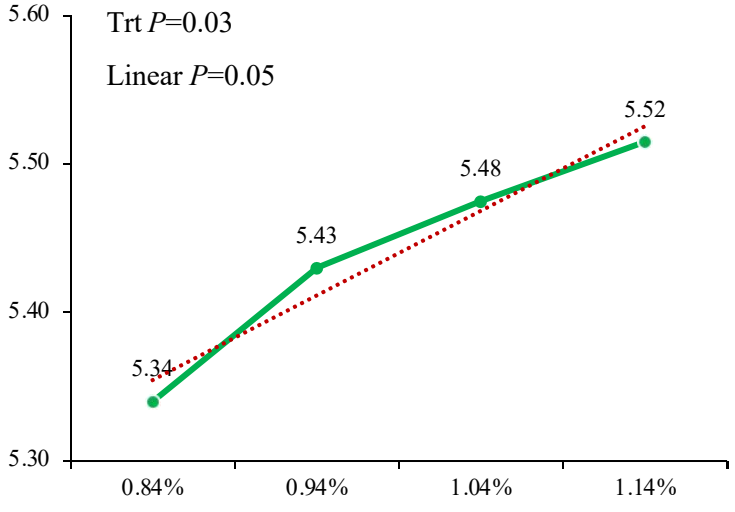
Average daily feed intake during lactation, kg/d



Average daily piglet weight gain over two breeding cycles, g/d



Weight of piglets at day 21 in two breeding cycles, kg

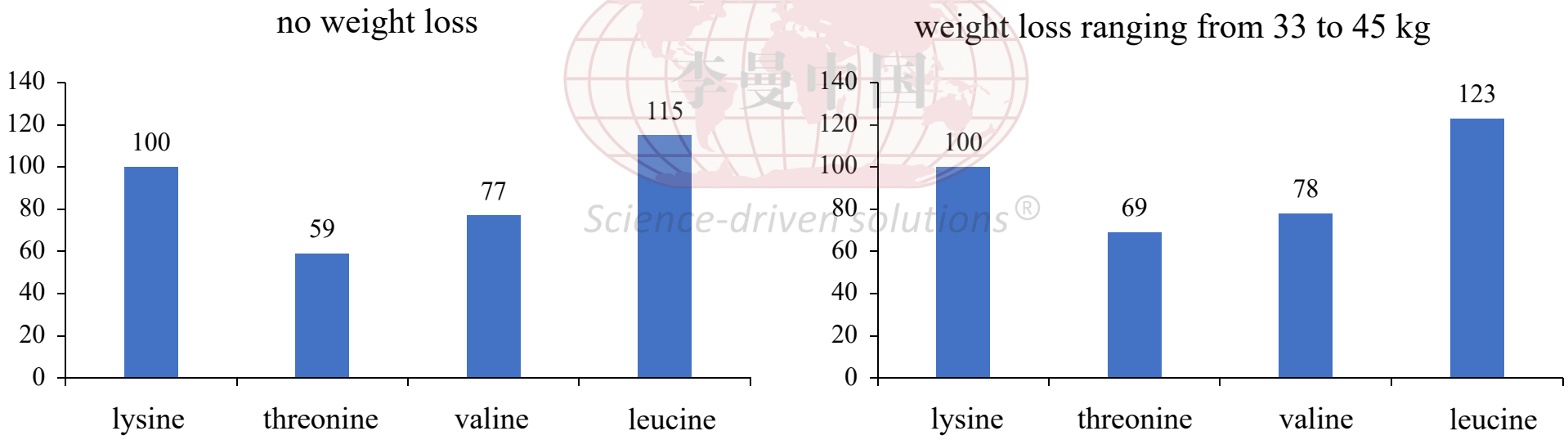


(Liu et al, 2020)

II. Low-protein Diets

2.2 Lactating Sows -Balanced Amino Acids

- The amino acid requirements and optimal ratio of lactating sows vary dynamically with the amount of protein that may be mobilized by the maternal tissues and are closely related to the voluntary feed intake and milk production of the sows
- The relative optimal ratios of lysine : threonine : valine : leucine were 100:59:77:115 and 100:69:78:123 for lactating sows at day 21 with no weight loss and 33 ~ 45 kg weight loss, respectively.



(Kim et al, 2009)

II. Low-protein Diets

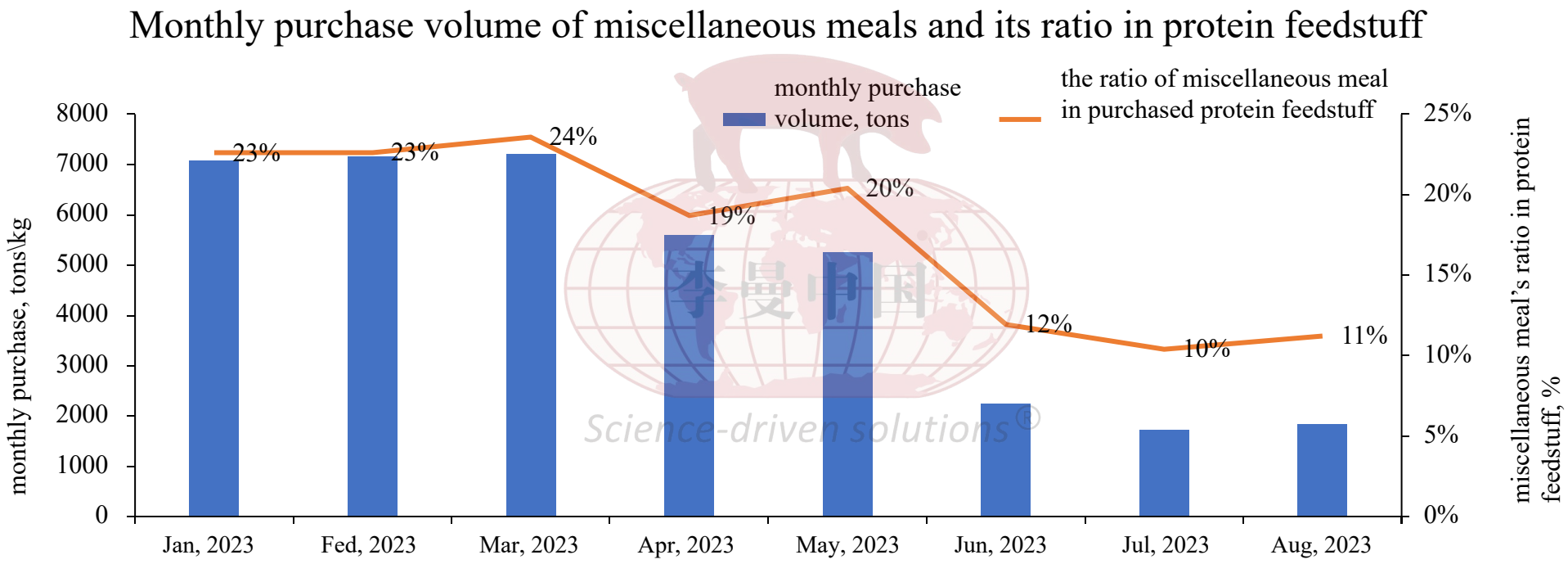
2.2 Lactating Sows -Balanced Amino Acids

Ratio of SID amino acid balance in diets for lactating sows with different nutritional standards

	PIC, 2022	CVB, 2020	Danish nutritional standards, 2022	NRC, 2012	Nutritional requirements of pigs in China, 2020	Nutritional Requirements of Pigs and Poultry in Brazil, 2017
Standard ileal digestible amino acid basis						
lysine	100	100	100	100	100	100
methionine	-	-	31	26	26	28
methionine+cysteine	53	60	58	53	53	56
threonine	64	63	65	63	63	65
tryptophan	19	19	20	19	19	22
valine	64	82	69	85	85	83
isoleucine	56	58	56	56	59	60
leucine	114	114	108	113	113	115
histidine	40	38	36	40	40	40
phenylalanine	-	56	55	54	54	58
phenylalanine+tyrosine	113	-	113	112	111	116

III. Feedstuff Substitution Programs

Monthly purchase volume of miscellaneous meals



Ingredients replacing soybean meal include: rapeseed meal, cottonseed meal, peanut meal, corn DDGS, grain DDGS, sunflower kernel meal, palm seed meal, stevia meal

(internal data)

III. Feedstuff Substitution Programs

3.1 Protein Feedstuff Substitution - rapeseed Meal

source	Additive ratio, %	sows	major conclusion	literature source	year
rapeseed meal	10%	gestation and lactation period, 3 breeding cycles	no impact on piglet birth weight, weaning weight, survival rate and litter weight gain.	Quiniou et al.	2012
rapeseed meal	30%	60 days of gestation and 21 days of weaning	intestinal lactic acid bacteria ↑; sow body weight and plasma urea nitrogen ↓; no adverse effect on milk composition and nutrient digestibility	Velayudhan et al.	2018
rapeseed press cake	gestation period：8% lactation period：14%	gestation and lactation period	piglet weight ↑; piglet growth rate ↑	Hanczakowska et al.	2012
fermented rapeseed meal	gestation period：4% lactation period：9%	gestation and lactation period	stimulate the immune and antioxidant systems	Czech et al.	2022
fermented rapeseed meal	gestation period：4% lactation period：9%	gestation and lactation period	litter size and litter weight ↑; nutrient digestibility ↑; harmful bacteria ↓.	Grela et al.	2019
fermented rapeseed meal	gestation period：4% lactation period：9%	gestation and lactation period	plasma Ht, Hb, RBC, minerals ↑; plasma total cholesterol, triacylglycerol ↓; liver enzyme activity ↓.	Czech et al.	2020

(Cheng et al, 2022)

III. Feedstuff Substitution Programs

3.1 Protein Feedstuff Substitution - corn DDGS

additive ratio, %	sows	major conclusions	literature source	year
15%, 30%	84 days of gestation - farrowing	DDGS diets have no significant impact on sow and farrowing performance	Corassa et al.	2022
15, 30, 45%	85 days of gestation - farrowing	DDGS diets have no significant differences on reproductive performance of sows	Xu et al.	2020
20, 40%	late stage of gestation period and lactation period	The addition of 400 g DDGS/kg (87 g lysine/kg) and 5.2 g lysine/kg to late gestation and lactation diets was sufficient to replace all soybean meal in the diet without significantly affecting the production performance of sows and piglets .	Wang et al.	2010
10, 20, 30%	lactating sows	DDGS diets have no significant impact on sow ADFI, backfat change and piglet growth performance	Song et al.	2010

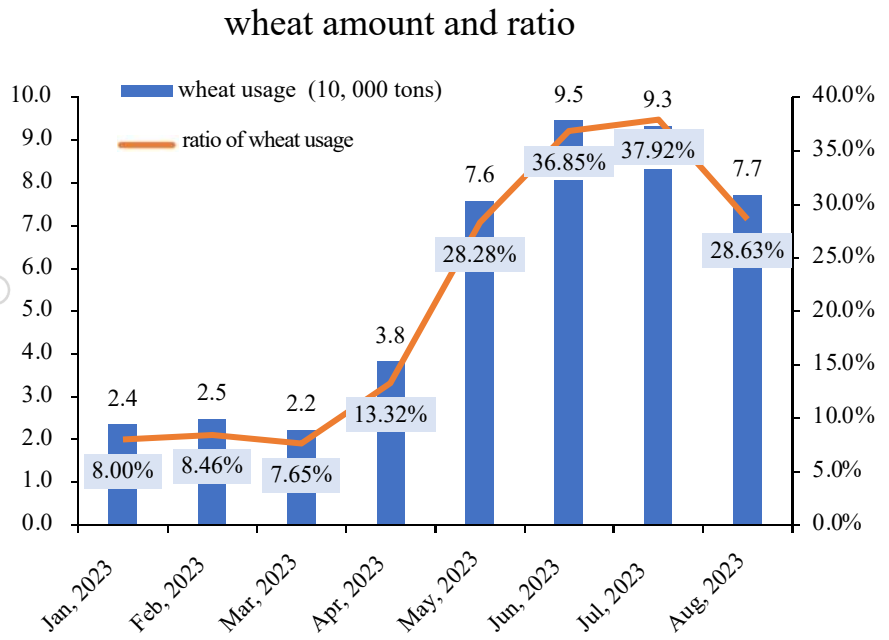
III. Feedstuff Substitution Programs

3.2 Feedstuff Substitution Technology -- Raw Grains

Protein Content of Major Raw Grains

	moisture (%)	crude protein (%)	crude fat (%)	crude ash (%)	crude fiber (%)	Neutral detergent fiber (%)	Acid detergent fiber (%)	starch (%)
domestic corn	12.9 (n=179)	7.86 (n=125)	3.42 (n=69)	1.16 (n=61)	1.86 (n=76)	7.49 (n=72)	1.96 (n=66)	66.03 (n=72)
wheat	11.4 (n=48)	13.0 (n=48)	1.52 (n=48)	1.53 (n=48)	2.14 (n=48)	9.10 (n=48)	2.32 (n=48)	60.46 (n=40)
American corn	14.28 (n=31)	7.18 (n=31)	3.25 (n=28)	1.21 (n=26)	1.66 (n=25)	6.98 (n=28)	1.69 (n=17)	64.60 (n=26)
Ukrainian corn	13.5 (n=4)	7.33 (n=3)	3.46 (n=3)	1.20 (n=3)	2.07 (n=3)	7.44 (n=3)	2.14 (n=3)	65.62 (n=3)
sorghum (America)	13.31 (n=216)	9.25 (n=23)	1.35 (n=21)	2.93 (n=21)	1.83 (n=30)	6.81 (n=24)	2.2 (n=15)	63.08 (n=67)
barley (France)	12.85 (n=17)	9.2 (n=17)	1.7 (n=9)	2.01 (n=10)	4.21 (n=16)	16.6 (n=10)	4.94 (n=9)	60.05 (n=7)
barley (Australia)	10.27 (n=9)	9.49 (n=9)	1.89 (n=6)	2.05 (n=8)	3.99 (n=9)	15.58 (n=8)	4.47 (n=7)	63.26 (n=4)
barley (Canada)	12.93 (n=3)	10.39 (n=3)	1.74 (n=3)	2.10 (n=3)	4.2 (n=3)	17.27 (n=3)	4.8 (n=3)	59.11 (n=3)

Ratio of wheat in feed formula



(internal data)

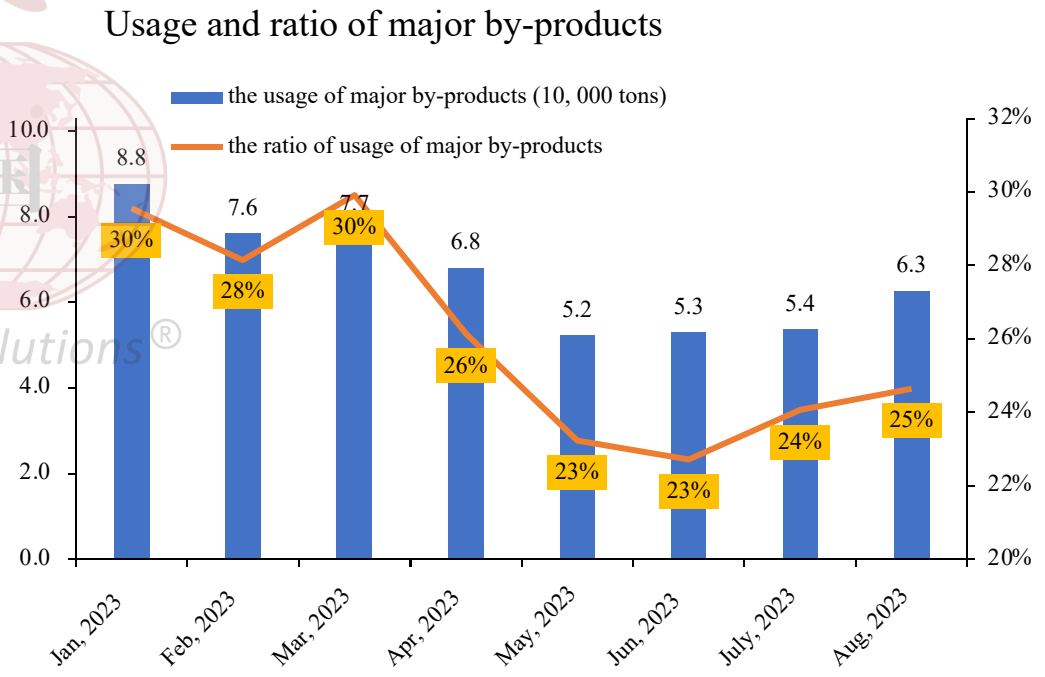
III. Feedstuff Substitution Programs

3.2 Feedstuff Substitution Technology-byproducts

The protein content of main byproducts

Feedstuff's Name (the name in EBS)	Laboratory Results						
	moisture	crude protein	crude ash	crude fat	crude fiber	neutral detergent fiber	starch
corn (for suckling pigs)	14.2	7.5	1.2	3.3	2.0	8.6	64.1
Corn (for medium and large pigs)	13.5	8.3	1.1	3.2	2.2	7.3	64.2
wheat shorts (the 3rd grade)	11.8	16.9	2.8	4.3	3.6	17.1	38.4
corn DDGS (8/24)	11.1	25.9	4.3	11.2	6.1	24.1	3.8
wheat germ (the 2nd grade)	13.5	27.0	4.6	8.8	3.9	16.0	
flour (1.5)	13.3	14.2	1.0	2.0	0.8	3.8	62.5
bran (5.5)	12.0	16.3	4.5	4.3	8.6	33.0	19.0

Ratio of by-products in feed formula is maintained at 20-30%



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IV. Control of Absolute Soybean Meal Usage

by reducing sows' feeding amount

- **Pay attention to the changes in the body condition of sows and adjust the feeding amount in time to avoid unnecessary feed cost.**
- **Eliminate bump feed in the late stage of gestation**

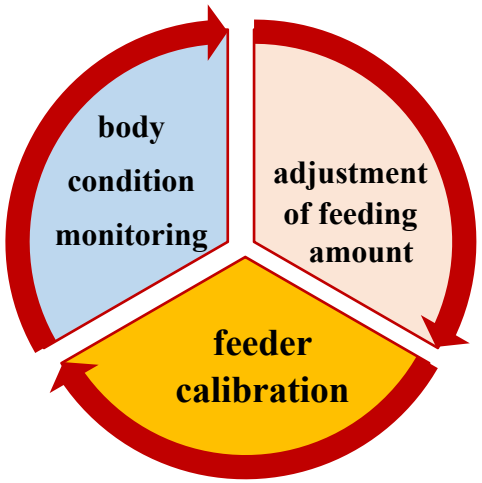
(2023.3, Changsha - The 11th Leman Conference)

IV. Control of Absolute Soybean Meal Usage

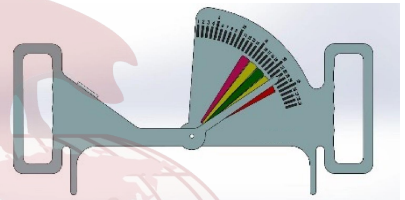
4.1 Management of sows' body condition

Management of gestating sows' body condition:

- is an important guarantee for improving the reproductive performance of breeding pigs
- is the key to controlling feed cost in breeding farms



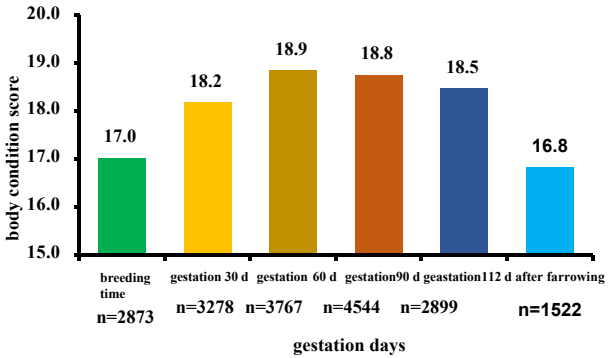
Key points of managing the body condition of gestating sows



body condition caliper:

1. Relatively accurate and objective measurements
2. Individual sow measurement is no more than 20 seconds, which saves time and manpower

Mean value of body condition measured by caliper in different stages of pregnancy (n=18, 883)



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Establish a standard for the use of body condition calipers-data foundations

Data of body condition of **18,883** sows at each gestation node;;

Data correlating body condition of **1,941** sows with farrowing performance;

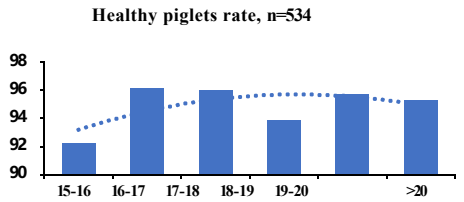
Data correlating body condition of **695** sows with pre-farrowing and post-farrowing weight;

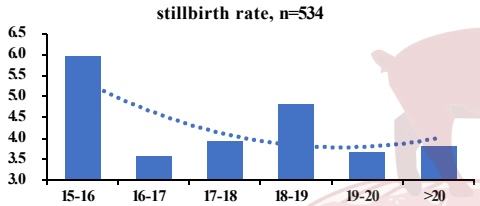
Data correlating feed intake of **405** sows with litter weight gain during lactation.

IV. Control of Absolute Soybean Meal Usage

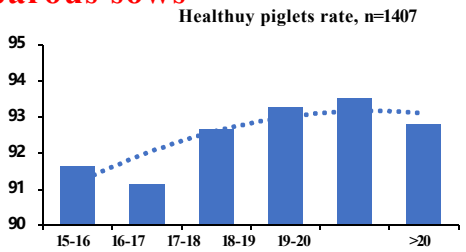
4.1Management of sows' body condition

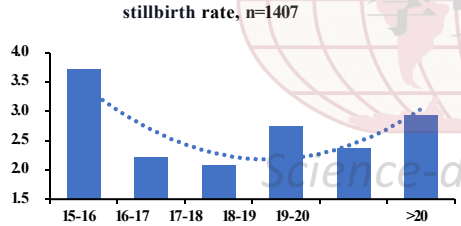
primiparous sows



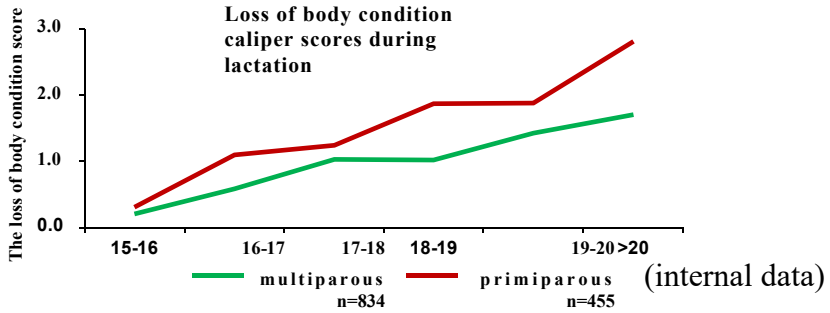


multiparous sows





Loss of body condition during lactation



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Considerations for establishing standards for body calipers:

1. Relationship between body condition caliper scores and farrowing performance in sows

A combination of healthy litter rate, stillbirth rate, mummy rate, etc.

2. Ensure basic body fat reserves of sows to avoid significant fat loss during lactation.

Primiparous sows lose more weight in lactation under the same body condition score range

Optimal body condition range of gestating sows:

17-20

IV. Control of Absolute Soybean Meal Usage

4.2 Feeding management in the late stage of gestation

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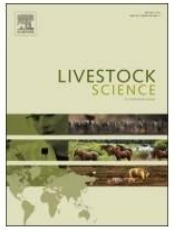


Bump feed for gestating sows is really necessary?

Vitor de Oliveira Araújo[a], Rafael Aquino de Oliveira[a], Maria de Fátima Araújo Vieira[a], Hebert Silveira[b], Leonardo da Silva Fonseca[c], Laya Kannan Silva Alves[d], Eduarda Buck Bernardes Guimarães[d], Allan Paul Schinckel[e], Cesar Augusto Pospissil Garbossa[d,*]

No differences were observed for treatments on **sow weight, weight gain, piglet birth weight, litter birth weight, coefficient of variation, number of total births, stillbirth, live births, and placental efficiency**.

IV. Control of Absolute Soybean Meal Usage

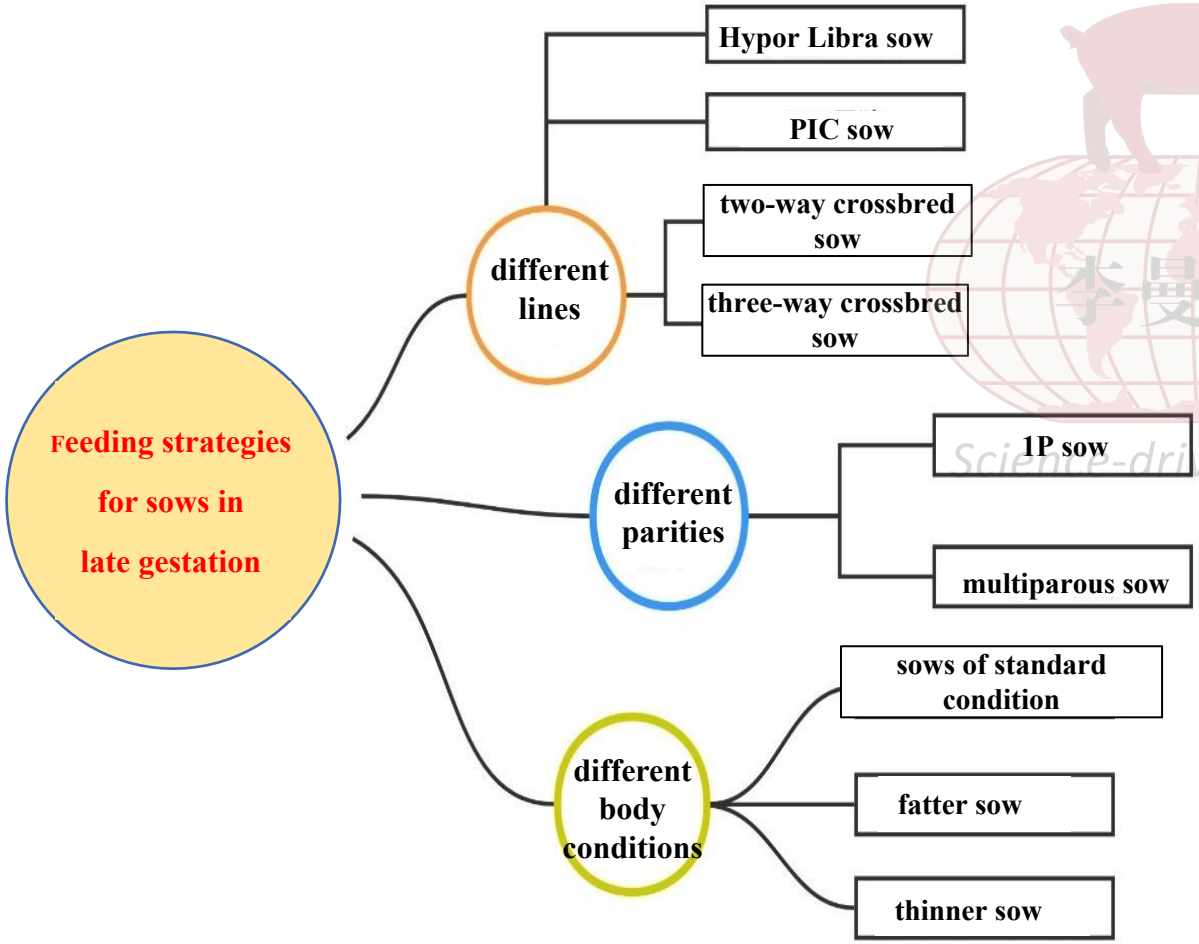
4.2Feeding management in the late stage of gestation -Related researches

- Since 2009, when questions were raised about the efficacy of bump feed in the late stage of gestation to increase birth weight, studies have been conducted at Kansas State University gradually.
- A summary of the literature shows that out of the 15 experimental data, only 5 indicated an increase in birth weight (>10 g)

literature	year	litter size	bump feed time	repetitive times	ME Mcal/d	SID Lys g/d	ME Mcal/d	SID Lys g/d	weight gain of sows, kg	increase birth weight , g
Shelton	2009	G	90	21	6.8	11.9	9.8	17.1	5.9	86.0
Goncalves	2016	G	90	185	5.9	10.7	8.9	10.7	3.0	0
Goncalves	2016	G	90	185	5.9	20	8.9	20	5.9	10.0
Mallmann	2018	G	90	50	5.9	11.7	7.2	14.3	2.2	6.0
Mallmann	2019	G	90	37	5.7	11	12.2	23.8	12.3	10.6
Mallmann	2019	G	90	41	5.7	11	12.2	23.8	6.6	0
Araújo	2020	G+S	81	35	7.8	16.8	9.75	21	3.7	-36.0
Shelton	2009	S	90	32	6.8	11.9	9.8	17.1	4.4	-109.0
Goncalves	2016	S	90	90	5.9	10.7	8.9	10.7	2.9	30.0
Goncalves	2016	S	90	90	5.9	20	8.9	20	4.5	10.0
Mallmann	2018	S	90	152	5.9	11.7	7.2	14.3	3.3	-4.0
Mallmann	2019	S	90	143	5.7	11	12.2	23.8	16.4	21.6
Mallmann	2019	S	90	136	5.7	11	12.2	23.8	19.0	68.3
Choi	2019	S	90	9	-	-	-	-	3.8	90.0
Ferreira	2021	S	75	43	5.8	12.1	7.4	15.4	8.9	0
weighted average value					5.9	13.2	9.5	17.7	7.8	11.5
standard deviation					0.6	3.2	1.8	4.6	5.4	47.5

IV. Control of Absolute Soybean Meal Usage

4.2 Feeding management in the late stage of gestation-Large Group Verification



- **Major conclusions:**

  Optimal sow body condition is a prerequisite for not implementing bump feeding

  1. Supplement feed in the late stage of gestation does not positively affect piglet birth weights

  2. Without supplement feed in the late stage of gestation, the weak piglet level is not increased when the number of live piglets is less than 14.

  3. Without supplement feed in the late stage of gestation, increasing feed intake during lactation in sows is beneficial for weaning weight of piglets.

- **Reduce the absolute soybean meal usage:**

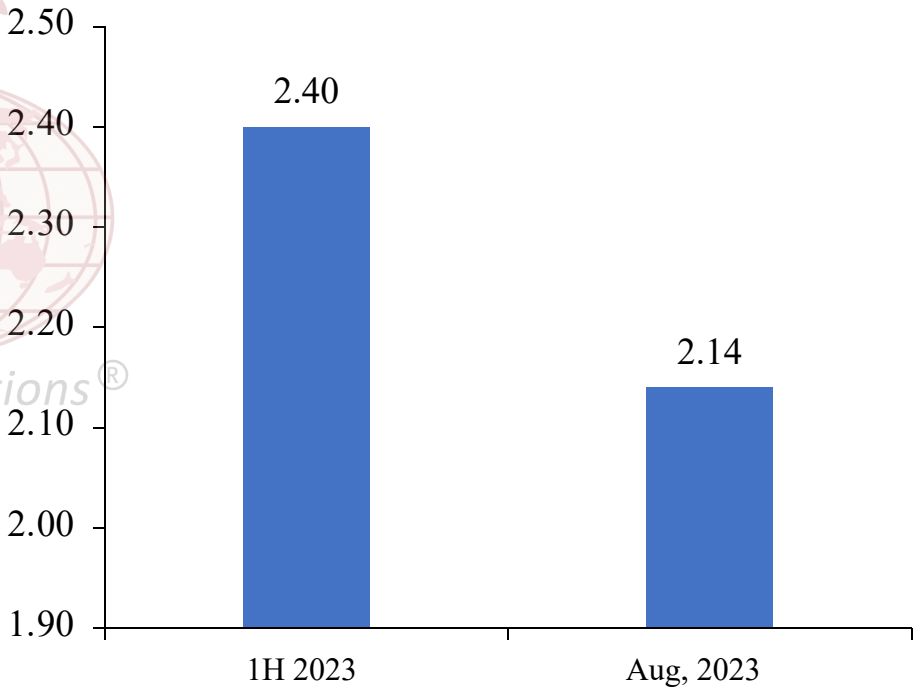
  Annually, 35 kg of feed is saved per sow (26 days, 0.6 kg/d reduction, 2.3 parities per year)

  Based on the addition of 4% of gestational diet soybean meal, the annual soybean meal is saved by 1.4kg per pig

IV. Control of Absolute Soybean Meal Usage

4.3 Implementation

- Gestating sow feeding is based on maintaining optimal body condition and focusing on the changes in body condition and adjust feeding amount in time
- Adopt a feeding strategy without bump feed in the late stage of gestation and focuses on meeting the herd's amino acid requirements
- The average feeding amount of sows in August was 2.14 kg/d, a reduction of 0.26 kg per day compared with the feed input in the first half of the year, which is expected to reduce the annual feed input by 67 kg/head, and reduce the annual usage of soybean meal by 2.68 kg/head.



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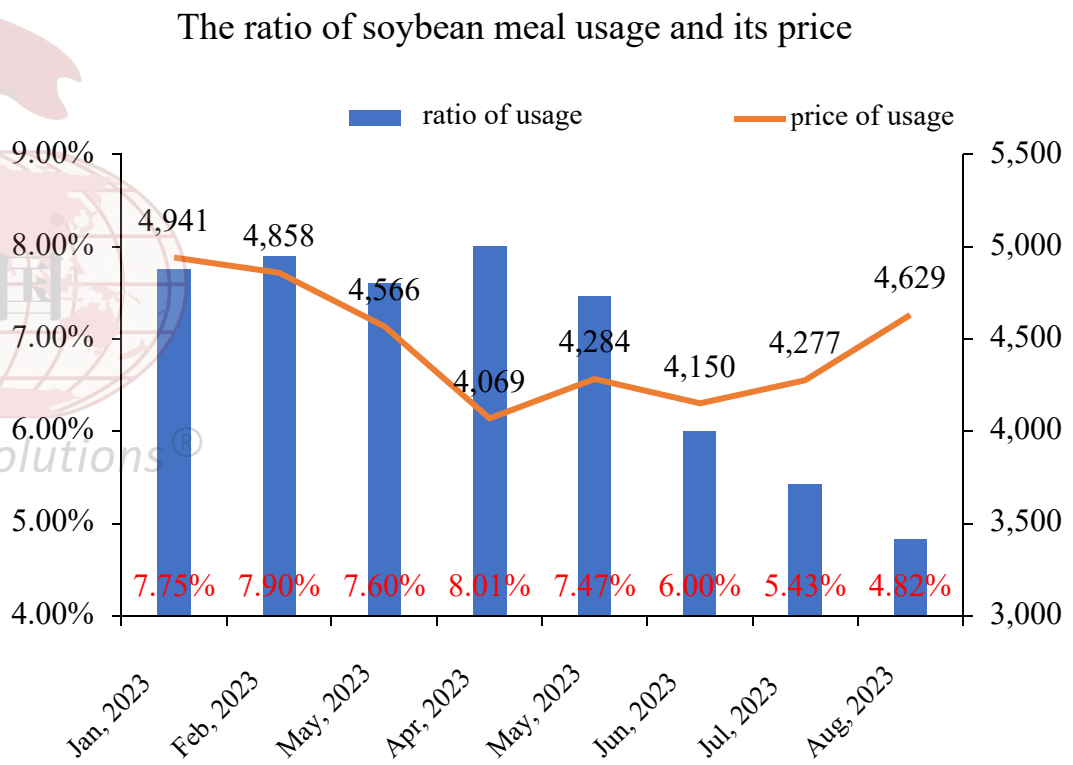
V. Summary

- Low soybean meal dietary standard is based on pig feed intake. The implementation of low protein diets is based on meeting amino acid requirements and balance.
- Utilize the feedstuff database and make full use of miscellaneous meals, by-products and wheat, etc., to optimize the formula structure and replace the use of soybean meal.
- By controlling the feeding of gestating sows and reducing the absolute usage of soybean meal, we require sows to maintain an optimal body condition. On the premise of meeting the nutritional requirements of sows and the growth requirements of piglets, bump feed is not implemented.

Changes in the ratio of soybean meal in the formula after feeding low soybean meal diet



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THANKS