The First Power In Genetics

GENESUS

Feeding Guidelines
Grow - Finisher

BETTER RESULTS SUSTAINED BY RESEARCH

Rock Lake Research Center in Ballaton, MN provides Genesus the ability to measure feed intake, gain, body composition and to ensure the diet specifications given are current and focused on cost per pound of gain.

Every eight weeks a group (1200 hd) of Genesus full program pigs are placed in the nursery to begin the process of evaluating and updating diet specifications.

This means every seven weeks a group of pigs are taken off-test and sent to harvest for evaluation of economically important performance, carcass and meat quality traits.

During the time in nursery/finisher, pigs are fed in stages as to determine the most profitable diets throughout the life of the pig. It is important to understand each stage to ensure the minimum requirement is met and to maximize profit by optimizing the balance between the animal's nutrient requirements, performance and carcass value.

Lysine, the first-limiting amino acid, is one of the most important ingredients of a diet. One of the things Genesus discovered in doing its research was, lysine was being overfed using average nutrient requirement recommendations. This was due to the high appetite of the Genesus pig. Since that time Genesus has updated ration recommendations resulting in improved feed conversion and lower cost of gain. However, lysine is not the only factor evaluated in a nutrient recommendation. The lysine/energy ratio and other amino acids are also important and play a critical role in optimizing cost per pound of gain.

The experimental period is broken into 3 categories:

In the nursery:

Pigs are split by sex and randomly allocated in a randomized complete block design, with weight as the block.

Approximately 25 (±2) pigs are assigned per pen, with 12 pens/treatment, allowing us to evaluate up to 5 different treatments per group.

All pens utilize nipple waterers that are set at the shoulder level of the smallest pig and adjusted as needed.

Pigs and feeders are weighed on day 0, 7, 14, 21, 28, 35, and 42 to calculate ADG, ADFI, and F/G, these frequencies can change depending on the trial.

An automated feeding system records the amount of feed distributed to each pen. In the event a pig died or became unfit for the trial it is removed and the date and weight is recorded for accurate calculations of feed intake and efficiency for a given pen.

In the finisher:

Pigs are split by sex and randomly allotted to a randomized complete block design, with weight as the block.

Approximately 25 (±1) pigs are assigned per pen, with 12 pens/treatment, allowing us to evaluate up to 5 different treatments per group.

All pens utilize nipple waterers that are set at the shoulder level of the smallest pig and adjusted as needed. Pigs and

feeders are weighed on day 0, 14, 28, 42, 56, 70, 84, 98, and 111 to calculate ADG, ADFI, and F/G, these frequencies can change depending on the trial.

An automated feeding system records the amount of feed distributed to each pen. The feed intake data generated from this system minus the weight of the feed remaining in the feeder at the end of each stage is used to calculate the cost per pound of gain. Body composition is also measured at each weigh day during the process using ultrasound technology.

Tissue samples are taken on animals are incorporated into the Genesus genomics program. In the event a pig died or became unfit for the trial it is removed and the date and weight is recorded for accurate calculations.

In the plant:

Pigs are transported to harvest after the test is complete to measure carcass composition and meat quality. The plant utilizes the same ultrasound technology as the farm does so Genesus is able to get an accurate measure of carcass composition.

At the completion of some trials, a subset of loins (or other primals) are used to do detailed carcass and meat quality work including: color, pH, marbling, tenderness, yields, etc.

The data collected during this phase of the process is also included in the Genesus genomics program as pigs are identified individually and genetically linked through the tissue samples taken.

Conclusion:

Measuring pigs from start to finish is the only way to accurately know the impact of nutritional recommendations.

The benefits for Genesus of doing this research are: improve growth rate, update diet specifications to optimize cost per pound of gain, incorporate commercial data into the genetic program, and to evaluate carcasses for composition and meat quality.

Genesus continues to focus on maximizing genetic improvement of economically important traits and optimum cost per pound of gain while maintaining a product that has the best eating experience.

The key. Ultra modern research facilities that utilize automatic feed recording equipment and a research protocol that includes bi-weekly weighing, live pig ultrasound testing, and packing plant carcass evaluation.

The goal?

Maximize Genesus customer profitability through lower cost of gain, optimum growth and meat quality.

Genesus feeding recommendations for nursery and finisher based on extended research done over the years can be found in this booklet (Table #2 and 3, page 8&9)

OPTIMAL FCR

As a genetic supplier, one of the first topics discussed in any meeting is feed conversion ratio (FCR).

While very easy value to calculate, it is important to know the relationship between FCR and profitability.

There are numerous factors that can contribute to the pigs FCR including: nutrition (i.e. pellets vs. mash, grind size, ingredients, etc.), housing (i.e. type of feeder, stocking density, temperature control, etc.), health, and genetics.

A paper written by Dr. Dean Boyd titled "Integrating Science into Practice and Getting it Right" determined the 10 most important metrics for profitability of the top 25% of firms (see Table 1).

Interestingly, FCR was ranked number 10, and the most profitable farms actually had worse caloric feed conversion ratio than the average farm. Thus, optimal FCR was more related to profitability than lowest FCR.

What does optimal FCR really mean?

The question really becomes, if we are trying to drive FCR as low as possible, what are we giving up and are we really driving profitability in the right direction? There are several ways to improve FCR, including, but not limited to:

- Selecting for faster growth, while holding feed intake constant;
- Selecting for lower feed intake, while holding growth constant;
- Selecting for faster growth and for lower feed intake. Each scenario has outcomes that may or may not be favorable with other production parameters.

Genesus has focused on maintaining feed intake at status quo and selecting for pigs that grow faster.

This allows the Genesus pig to improve on FCR, yet handle stressors (i.e. diseases challenge, out of feed events, management, etc.) it encounters.

Understanding how to feed an animal to its appetite and nutritional needs is critical to profitability.

Since most genetic providers focus on FCR as a main trait they have pushed down the intake of the animal, and these can't be fed the same way as animals that have a higher appetite.

Table 1

Performance Mean and Relative Advantage						
Metric	Unit	Average	Top 25%	Advantage[2]	Rank	Outcome
Post–weaning mortality	%	9.5	6.8	1.290	1	No. pigs
Culled at barn close	%	2.8	2.1	1.253	2	No. pigs
Pre-wean mortality	%	14.8	13.4	1.094	3	No. pigs
Market price	$/100 lb	52.2	56.1	1.075	4	Price
Total finish cost	$/100 lb	49.0	45.9	1.064	5	Cost
Wean pig cost	$/Pig	27.8	26.4	1.049	6	Cost
Finish feed cost	$/Ton	206.4	199.5	1.033	7	Cost
Wean pigs/mated sow	Pigs	23.7	24.4	1.030	8	No. pigs
Caloric FCR, Finish	Kcal ME/lb	3874	3906	.992	10[3]	Cost

1 Agri Stats Inc., (N = 68 firms)

2Advantage = computed to be the fold-difference of the Top 25% over/under the average

3 Item 9, days to market, not shown but was equivalent for the Average and Top 25%

To get the best performance you must feed to the appetite and nutritional needs of that line and not to the lowest FCR, otherwise, as we have found, we are overfeeding things like lysine, energy, phosphorus and causing non-optimal performance and costing a lot of money.

Is clear that cost per pound of gain is an important piece of profitability as feed represents 65-75% of the total cost of producing a slaughter pig.

Feed Intake

Feed intake is very often overlooked as a production factor in favor of FCR. It is however an absolutely vital production parameter and one that is very easy to monitor.

Voluntary feed intake is a trait with significant genetic influence. The expression of a pigs genetic potential for food intake can be reduced by various factors including health, high temperature, feeder design and setting and restrictions to water.

For a nutritionist, knowing feed intake is absolutely essential when it comes to doing diet specifications (it is impossible to do if you do not know what feed intake is).

Nutritionists first need to know the pigs potential for growth (g/day). They then need to calculate how much energy / protein / lysine etc.. the pig needs per day to achieve this potential.

Next they need to know how much food the pig will eat (kg/day) to then decide how much energy / protein / lysine etc.. to put into each kg of food. If they do not know what the feed intake is then it is impossible to know how much nutrients to put into each kg of food!!

If pigs eat more food than was expected, then there is oversupply of ingredients. Some of these are turned into extra fat and others wasted. The outcome; fatter pigs with poorer FCR than expected.

If the pigs eat less food than expected then nutrients are restricted. This leads to lower growth rate than expected. This can also reduce FCR.

Remember, to meet the pigs requirements, nutrition is a combination of feed intake and nutrient density. If either is wrong (or not in balance) then nutrition is wrong and for sure either pigs will be growing more slowly than expected, or fatter or thinner than expected or FCR will be worse than expected.

Not all pigs are the same!

There are some very big differences between breeding companies in population average feed intake. Genesus knows from trials we have done compared with other breeding companies that our feed intake can be up to 20% higher than some of the competition! 20% higher feed intake is clearly very significant.

Feeding two different populations with same diets, is quite obvious going to give very different results!

Each breeding company has specific requirements that are a result of their breeding strategy. There is no 'common strategy' there is no 'one diet fits all'. If you want to get the best performance from a type of genetics, you have to follow its nutritional requirement (diet specification and feed intake).

Feed intake is directly related to growth rate. The more pigs eat, the faster they can grow. Restricting feed intake restricts growth rate. Depending upon company structure the value of growth rate in a system can vary.

Genesus expects pigs in finisher to be eating about 5.5lbs or 2.5kg per day on average (of course less at the start of period and more at the end). When we see feed intakes of about 4.6lbs or 2.1kg we know pigs are being restricted. Growth percentage will be even lower as animals will first meet their maintenance needs and what is left over can be used for growth.

Remember always that FCR as a factor on its own means very little. The important factor is feed cost per kg of gain (or per pig). This is a function of cost of feed per tonne, feed intake and growth!

Remember to monitor feed intake (it is not difficult – most farms get feed weekly so know feed intake). If it is lower than expected, investigate why.

Table 2. Nursery specifications

Nursery	SEW	Starter 1	Starter 2	Starter 3	Pre Grower
Initial weight (lb, kg)	*9, 4*	*13, 6*	*16, 7*	*29, 13*	*46, 20*
Final weight (lb, kg)	*13, 6*	*16, 7*	*29, 13*	*46, 20*	*60, 27*
Pig age, days[1]	< 21	21-28	28-42	42-56	56-65
ADFI, (lb, kg)		0.46, 0.21	1.22, 0.55	1.92, 0.88	2.46, 1.12
ADG, (lb, kg)		0.41, 0.19	0.94, 0.43	1.19, 0.54	1.43, 0.65
Nutrient Levels	**SEW**	**Starter 1**	**Starter 2**	**Starter 3**	**Pre Grower**
NE, kcal/kg (NRC)	2550	2550	2500	2450	2450
SID Lysine, %	1.45	1.42	1.37	1.27	1.20
SID Lysine:NE, g/Mcal	5.88	5.58	5.49	5.20	4.69
SID Met+Cys:Lysine, %	58	58	58	58	58
SID Threonine:Lysine, %	60	60	60	60	61
SID Tryptophan:Lysine, %	18.5	18.5	18.5	18.5	18.5
SID Valine:Lysine, %	67	67	67	67	67
SID Isoleucine:Lysine, %	55	55	55	56	56
SID Leucine:Lysine, %	100	100	100	100	100
Ca, %	0.78	0.78	0.80	0.80	0.80
Ca:NE g,Mcal	3.27	3.27	3.14	3.20	3.06
Av P %	0.55	0.50	0.50	0.40	0.39
Ca: Av P	1.42	1.55	1.60	2.00	2.03
Na, %	0.32	0.32	0.3	0.28	0.22
Lactose, %	24	16	8	0	0
Zinc, ppm	3000	3000	2000	150	150
Iron, ppm	150	150	150	150	150
Manganese, ppm	50	50	50	50	50
Copper, ppm	145	145	145	145	145
Iodine, ppm	1.0	1.0	1.0	1.0	1.0
Selenium, ppm	0.3	0.3	0.3	0.3	0.3
Vit A, IU/kg	12000	12000	12000	12000	12000
Vit D, IU/kg	1500	1500	1500	1500	1500
Vit E, IU/kg	90	90	90	90	90
Vit K, mg/kg	5.0	5.0	5.0	5.0	5.0
Vit B12, mg/kg	0.06	0.06	0.06	0.06	0.06
Niacin, mg/kg	60	60	60	60	60
Pantothenic Acid, mg/kg	35	35	35	35	35
Thiamine, mg/kg	3.0	3.0	3.0	3.0	3.0
Riboflavin, mg/kg	12	12	12	12	12
Biotin, mg/kg	0.2	0.2	0.2	0.2	0.2
Folic acid, mg/kg	1.0	1.0	1.0	1.0	1.0
Choline, mg/kg	600	600	600	600	600
Pyridoxine, mg/kg	6.0	6.0	6.0	6.0	6.0

[1] *Age and weight is important to determine appropriate diet*

Table 3A. Grow-Finish specifications

Gilts	Grower 1	Grower 2	Finisher 1	Finisher 2	Finisher 3	Finisher 4	Paylean Finisher
Initial weight (lb, kg)	**60, 27**	**95, 43**	**140, 64**	**180, 82**	**220, 100**	**240, 109**	**240, 109**
Final weight (lb, kg)	**95, 43**	**140, 64**	**180, 82**	**220, 100**	**240, 109**	**270, 123**	**275, 125**
ADFI, (lb, kg)	*3.63, 1.65*	*4.87, 2.21*	*5.46, 2.48*	*5.68, 2.58*	*5.72, 2.6*	*6.3, 2.86*	*6.3, 2.86*
ADG, (lb, kg)	*2.13, 0.97*	*1.95, 0.88*	*2.04, 0.93*	*2.01, 0.91*	*1.67, 0.77*	*1.88, 0.85*	*1.94, 0.88*
FCR	*1.79*	*2.50*	*2.68*	*2.84*	*3.47*	*3.36*	*3.24*
Barrows	**Grower 1**	**Grower 2**	**Finisher 1**	**Finisher 2**	**Finisher 3**	**Finisher 4**	**Paylean Finisher**
Initial weight (lb, kg)	**60, 27**	**85, 39**	**130, 59**	**170, 77**	**210, 95**	**235, 107**	**235, 107**
Final weight (lb, kg)	**85, 39**	**130, 59**	**170, 77**	**210, 95**	**235, 107**	**270, 123**	**275, 125**
ADFI, (lb, kg)	*3.64, 1.65*	*5.12, 2.32*	*6.31, 2.86*	*6.79, 3.08*	*6.8, 3.08*	*7, 3.18*	*7, 3.18*
ADG, (lb, kg)	1.93, 0.88	2.02, 0.91	2.28, 1.03	2.17, 0.98	1.91, 0.86	1.94, 0.88	2.1, 0.95
FCR	2.20	2.54	2.77	3.15	3.62	3.60	3.33
Nutrient Levels	**Grower 1**	**Grower 2**	**Finisher 1**	**Finisher 2**	**Finisher 3**	**Finisher 4**	**Paylean Finisher**
SID lysine:ME, g/Mcal	3.37	3.07	2.73	2.35	2.15	1.91	2.80
SID lysine:NE, g/Mcal	4.48	4.02	3.54	3.09	2.76	2.45	3.60
SID Met+Cys:Lysine, %	57	57	57	57	57	57	57
SID Threonine:Lysine, %	62	63	64	64	64	64	64
SID Tryptophan:Lysine, %	17	17.5	18	18	18	18	18
SID Valine:Lysine, %	65	65	65	65	65	65	65
SID Isoleucine:Lysine, %	56	56	56	56	56	56	56
Ca, %	0.6	0.5	0.5	0.45	0.45	0.45	0.45
Av P %	0.35	0.35	0.3	0.28	0.25	0.25	0.3
Ca: Av P	1.71	1.43	1.67	1.61	1.80	1.80	1.50
Na, %	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Zinc, ppm	100	100	100	80	70	70	100
Iron, ppm	100	100	100	80	70	70	100
Manganese, ppm	40	40	40	32	28	28	40
Copper, ppm	10	10	10	10	10	10	10
Iodine, ppm	1.00	1.00	1.00	0.80	0.70	0.70	1.00
Selenium, ppm	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Vit A, IU/kg	5510	5179	4849	4518	4188	4188	4849
Vit D, IU/kg	1047	959	871	782	782	782	871
Vit E, IU/kg	33	30	30	24	22	22	30
Vit K, mg/kg	2.6	2.0	2.0	1.5	1.3	1.3	2.0
Vit B12, mcg/kg	22.0	19.8	19.8	17.6	15.4	15.4	19.8
Niacin, mg/kg	26.4	24.2	22.0	19.8	19.8	19.8	22.0
Pantothenic Acid, mg/kg	16.5	15.0	13.7	12.3	12.3	12.3	13.7
Riboflavin, mg/kg	5.0	4.8	4.8	4.7	4.7	4.7	4.8

Genesus energy levels are expressed as Net Energy (NE) based on NRC (2012) energy system.
Nutritionist should adapt it to system which is currently in use.

Table 3B. Grow-Finish Specifcations Intact Male Markets

INTACT MALES & GILTS (MIXED SEX)	PREGROWER	GROWER	FINISHER 1	FINISHER 2
Initial weight, kg	25	50	75	100
Final weight, kg	50	75	100	125
Expected feed intake, kg/d [1]	1.82	2.56	3.03	3.32
Expected liveweight gain, g/d	880	1062	1094	1056
DAILY REQUIREMENTS (MIXED SEX)				
SID Lysine, g/d	18.5	22.3	21.2	20.2
SID Threonine, g/d	11.8	14.3	13.6	12.9
SID Methionine, g/d	5.4	6.5	6.1	5.9
SID Methionine + Cysteine, g/d	10.5	12.7	12.1	11.5
SID Tryptophan, g/d	3.5	4.2	4.0	3.8
SID Valine, g/d	12.0	14.5	13.8	13.1
DIETARY SPECIFICATIONS (MIXED SEX)				
STTD P, % (minimum)	0.4	0.35	0.33	0.3
Total Calcium:STTD P ratio, g/g	1.74	1.79	1.79	1.79
STTD P:Net Energy ratio, g/MJ	0.42	0.36	0.33	0.31
STTD P:Net Energy ratio, g/Mcal	1.75	1.5	1.4	1.3
SID Lysine:Net Energy ratio, g/MJ	1.05	0.91	0.79	0.69
SID Lysine:Net Energy ratio, g/Mcal	4.4	3.8	3.3	2.9
Sodium, %	0.2	0.2	0.2	0.2
Chloride, %	0.4	0.3	0.3	0.3
TRACE MINERALS:				
Zinc, ppm	100	100	80	70
Iron, ppm	100	100	80	70
Manganese, ppm	40	40	32	28
Copper, ppm	10	10	10	10
Iodine, ppm	1	1	0.8	0.7
Selenium, ppm	0.3	0.3	0.3	0.3
VITAMINS:				
Vitamin A, IU/kg	5500	4800	4500	4200
Vitamin D, IU/kg	1050	900	780	780
Vitamin E, IU/kg	70	70	50	50
Vitamin K, mg/kg	2.6	2	1.5	1.3
Vitamin B12, mcg/kg	22	20	17.5	15.5
Niacin, mg/kg	26	22	20	20
Pantothenic Acid, mg/kg	17	14	12	12
Riboflavin, mg/kg	5	4.8	4.7	4.7

[1] Intakes based on a diet containing 9.6 MJ (2.3 Mcal) net energy/kg

HIGH FEED INTAKE

⇓

FASTER GROWTH

⇓

LESS DAYS TO MARKET

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