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The Effect on Pig's Growth and Meat Quality from PRIMOS 25, an Applied Microbial Mixed Feed

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The Effect on Pig's Growth and Meat Quality from PRIMOS 25, an Applied Microbial Mixed Feed

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SUMMARY

PRIMOS 25 is a microbial mixed feed developed by Vantaron Pte Ltd of Republic of Singapore. It is designed and developed to reduce the use of growth enhancing drugs for livestock. It uses 100% naturally derived ingredients and is produced based on human food standard. The effects and production benefits of this product have been seen by swine research institutes and farm operators in some ASEAN countries. PRIMOS 25 began to sell as microbial mixed feed in Japan by sole distributor, Anrisa Limited. The effect of PRIMOS 25 on growth, carcass quality, meat quality and meat taste were compared on piglets after weaning and growing-finishing pigs. Each trial showed improvement in F.C.R. (Feed Conversion Ratio) for piglets and growing pigs fed with 0.05% or 0.1% of PRIMOS 25. The improvement in A.D.G. (Average Daily Weight Gain) was seen, and the reduction of backfat helped to achieve higher carcass meat grading. The meat analysis showed that the cutting strength was higher. However, there was no difference in the fatty acid composition between the control and PRIMOS 25-fed groups. Meat-tasting showed no significant difference. The result of backfat reduction was achieved when PRIMOS 25 was fed at 0.1% to growing-finishing pigs. We conclude that PRIMOS 25 has a beneficial effect on the growth rate of pigs and feed consumption. Furthermore, a significant effect on backfat reduction was observed.

MATERIALS & METHOD

1. Feed used

Table 1 – Base Feed Composition¹

Weight of pig	TDN ²	Crude protein	Crude fat	Crude fibre	Crude ash	Ca	P
> 70 kg	74.0	15.0	2.0	7.0	8.0	0.7	0.55
30 to 70 kg	78.0	16.0	2.5	4.0	8.0	0.5	0.40
10 to 30 kg	84.0	22.0	3.0	2.0	4.0	0.5	0.40

¹ Based on Japanese Feeding Standard for Swine (2005).

² TDN: Total Digestible Nutrients = digestible crude protein (kg) + 2.25 × digestible crude fat (kg) + digestible crude fibre (kg) + digestible nitrogen free extract (kg)

2. Pigs

For each trial, the pigs in PRIMOS 25-fed Group and in Control Group come from the same litter and are evenly distributed in terms of sex and weight. All sows have been vaccinated against Atrophic Rhinitis. Vaccination programme for the pigs is as follows:

- Mycoplasma hyopneumoniae at age between 1 and 3 weeks old
- Porcine Pleuropneumonia at age between 4 and 8 weeks old

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- Swine Erysipelas

All male pigs have been castrated within 2 weeks after birth.

3. Breeding Management

Breeding management is conducted following the “Swine Breeding Management: Animal Welfare Approach” guidelines established by the Japan Livestock Technology Association (Tokyo).

Breeding house is a partially windowed, comprised of stainless-grating-laid concrete floor and equipped with continuous auto-feeder. The wall facing the one group of pens is shielded with hard-plastic wall to prevent any contact from the other group. PRIMOS 25 is homogenously mixed with the feed using electric mini-auto mixer at a rate of 20-kg of the base feed.

4. Inspection Method and Criteria

A total of four separate trials are carried out. Table 2 summarizes the details of each trial. A.D.G. and F.C.R. are compared in all the trials; parameters 4), 5) and 6) are inspected in Trial #2; parameter 3) is inspected in Trial #3 and Trial #4.

Table 2 – Trials

Trial #	PRIMOS 25 in feed	Breed type	Number of pigs		Ave. initial weight (kg)	Ave. end weight (kg)
			PRIMOS 25	Control		
1	0.05%	Berkshire	8	8	9.8	23.4
2	0.05%	Berkshire x Duroc	4	4	24.4	108.4
3	0.05%	Large Yorkshire x Landrace	8	8	21.5	101.7
4	0.1%	Large Yorkshire x Landrace	6	6	52.5	109.2

Parameters measured:

- 1) Average Daily Weight Gain (A.D.G.): weight increased / number of days
- 2) Feed Conversion Ratio (F.C.R.): feed intake/weight increased
- 3) Backfat Thickness: The backfat on both area of 5cm at left and right 1/2 of whole body around the *Longissimus dorsi* muscles is inspected by using ultrasonic wave meat inspection machine (Machine: Supper Eye FHK) based on current pork meat inspection guidelines.
- 4) Carcass Meat Evaluation Result: body length, body width, shoulder and back hip fat thickness, learn meat area, grading.
- 5) Meat Quality Inspection: pH, meat color, fat color, water retention, extension ratio, drip loss, heated loss, meat juice ratio, meat cutting strength, melting point of backfat, eye of the *Longissimus dorsi* are inspected following guidelines by the Pork Meat Quality Improvement Research Institute. Meat color and fat color are inspected by using color inspection equipment (Machine: Minolta CR-300); meat cutting strength is inspected by using rheometer (Machine: Yamaden RE-3305); fatty acid composition is inspected by using Gas Chromatograph (Machine: Shimazu Seisakusho GC-2014AFSC) after a methyl-esterification.

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- 6) Meat Taste Inspection: block meats from *Longissimus dorsi* are cut into sizes of 1.5cm x 1.5cm with 1cm fat remained, lightly-salted and lightly-browned on a hot-plate. A panel of 28 “tasters” evaluates the different flavor criteria as either “good” or “bad”.

5. Statistical Analysis

Statistical analysis is done taking t-value of the average minus the difference due to PRIMOS 25. Confidence level at $p < 0.1$ and $p < 0.05$ are taken into consideration as being significant and highly significant respectively.

RESULTS

Trial 1

PRIMOS 25 is tested at 0.05% the feed of Berkshire weanling piglets. There is no statistical difference for A.D.G at $p < 0.1$. F.C.R. shows better results with PRIMOS 25.

Table 3 –PRIMOS 25 at 0.05% in weanling pig feed

	PRIMOS 25	Control	<i>p</i> value
Number of pigs	N = 8	N = 8	
Initial weanling weight (kg)	9.9 ± 1.9	9.6 ± 2.2	0.80
Weight (kg) at 30 days old	24.4 ± 3.4	22.4 ± 4.5	0.33
A.D.G. (g)	502 ± 80	442 ± 92	0.19
F.C.R.	1.90	2.14	

Trial 2

PRIMOS 25 is tested on mixed feed in growing-finishing pigs of Berkshire x Duroc crosses. Final weight is targeted at 110 kg in order to subject the carcasses for meat inspection in accordance to the carcass grading guidelines established by the Japan Meat Grading Association.

1) A.D.G., F.C.R. and carcass quality results

PRIMOS 25 at 0.05% provides an improvement in the grading of pigs from “Prime” to “Premium” ($p < 0.05$). This improvement in grading is achieved by overall fat reduction and increase in meat quantity (Table 4).

Table 4 – A.D.G, F.C.R. and carcass meat results with PRIMOS 25 at 0.05%

	PRIMOS 25	Control	<i>p</i> Value
Number of pigs	N = 4	N = 4	
A.D.G. (g)	534.9 ± 13.0	505.8 ± 27.3	0.102
F.C.R.	2.84	3.00	
Carcass weight (kg)	70.7 ± 1.7	67.2 ± 3.4	0.111
Carcass meat yield ratio (%)	63.4 ± 0.2	64.0 ± 0.7	0.160
Grade (c)	1.0 ± 0	1.8 ± 0.5	0.024 (a)
Body length (cm)	93.6 ± 1.9	92.5 ± 2.0	0.427

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Body width (cm)	34.3 ± 0.9	32.6 ± 1.5	0.087 (b)
Back hip length I (cm)	78.5 ± 2.3	77.7 ± 1.7	0.603
Back hip length II (cm)	68.8 ± 2.1	68.4 ± 1.8	0.783
Shoulder fat thickness (cm)	3.5 ± 0.1	3.9 ± 0.4	0.091 (b)
Backfat thickness (cm)	2.0 ± 0.1	2.4 ± 0.2	0.049 (a)
Hip fat thickness (cm)	3.1 ± 0.2	3.6 ± 0.5	0.073 (b)
Average fat thickness (cm)	2.9 ± 0.1	3.3 ± 0.4	0.066 (b)
Learn meat area (cm)	35.1 ± 3.5	35.7 ± 4.0	0.834

(a): highly significant at $p < 0.05$

(b): significant at $p < 0.1$

(c): Japan Meat Grading Association: Premium = 1; Prime = 2; Regular = 3

2) Meat quality results

Except for a notable difference in the meat cutting strength ($p < 0.05$), there is no difference in the meat quality between PRIMOS 25-fed pigs and control pigs.

Table 5 – Meat quality inspection result with PRIMOS 25 at 0.05%

	PRIMOS 25	Control	<i>p</i> Value
Number of pigs	N = 4	N = 4	
PCS	3.3 ± 0.4	3.0 ± 0.0	0.134
Meat color L -Value	45.6 ± 1.6	46.3 ± 1.3	0.536
Meat color a -Value	9.7 ± 0.5	10.1 ± 0.5	0.352
Meat color b -Value	1.3 ± 0.8	1.2 ± 0.6	0.715
Fat PCS	1.5 ± 0	1.5 ± 0	1.000
Fat color L -Value	73.4 ± 0.3	73.5 ± 2.5	0.986
Fat color a -Value	3.2 ± 0.5	3.4 ± 1.2	0.352
Fat color b -Value	2.6 ± 0.3	2.8 ± 0.3	0.715
pH	5.7 ± 0.1	5.6 ± 0.0	0.192
Water retention (%)	84.6 ± 2.6	86.0 ± 3.2	0.520
Extension ratio (%)	29.2 ± 2.9	30.2 ± 3.1	0.656
Moisture contents (%)	72.1 ± 1.1	73.1 ± 0.9	0.210
Heat lost (%)	30.5 ± 12.0	25.4 ± 2.0	0.436
Meat juice ratio (%)	42.2 ± 0.6	41.7 ± 1.5	0.545
Melting point of backfat	37.3 ± 1.0	37.7 ± 0.9	0.556
Meat cutting strength × 10 ⁷ (N/m ²)	9.0 ± 1.2	6.9 ± 0.4	0.017(a)

(a): highly significant at $p < 0.05$

(b): significant at $p < 0.1$

3) Fatty acid composition results

There is no difference in the fatty acid composition of the backfat between PRIMOS 25-fed pigs and control pigs.

Table 6 – Fatty acid composition of the backfat with PRIMOS 25 at 0.05%

Fatty acid (%)	PRIMOS 25	Control	p Value
C14:0	1.1 ± 0.0	1.2 ± 0.0	0.730
C16:0	25.9 ± 0.7	26.2 ± 0.9	0.683
C16:1	2.0 ± 0.4	2.1 ± 0.5	0.700
C18:0	13.2 ± 1.1	13.2 ± 1.4	0.957
C18:1	46.2 ± 1.6	46.1 ± 1.0	0.879
C18:2	9.2 ± 0.5	9.1 ± 0.4	0.752
C18:3	0.5 ± 0.01	0.5 ± 0.06	0.356

4) Meat flavor results

There is no difference flavor of the meat between PRIMOS 25-fed pigs and the control pigs, as assayed by a panel of 28 “tasters”.

Table 7 – Meat flavour results* with PRIMOS 25 at 0.05%

	Fragrance	Taste	Softness	Overall
PRIMOS 25	64%	54%	39%	54%
Control	25%	39%	43%	46%

* Results are based on the average of a panel of 28 “tasters” who evaluated each individual criterion as “Good”.

Trial 3

The effect of PRIMOS 25 at 0.05% is tested and compared in crossed-bred Large Yorkshire x Landrace.. A highly significant improvement ($p < 0.05$) in A.D.G. and final weight is observed in PRIMOS 25-fed pigs.

Table 8 – A.D.G., F.C.R. and backfat thickness with PRIMOS at 0.05%

	PRIMOS 25	Control	p Value
	N = 8	N = 8	
Start weight (kg)	21.6 ± 1.6	21.1 ± 4.0	0.75
Final weight (kg) at 98 days old	107.8 ± 6.7	97.4 ± 4.5	0.04 (a)
A.D.G. (g)	879 ± 69	779 ± 90	0.03 (a)
F.C.R.	4.08	4.23	
Backfat thickness (cm)	1.2 ± 0.1	1.3 ± 0.2	0.20

(a): highly significant at $p < 0.05$

(b): significant at $p < 0.1$

Trial 4

The effect of PRIMOS 25 at 0.1% is tested and compared in crossed-bred Large Yorkshire x Landrace. A significant improvement in A.D.G. ($p < 0.1$) and a highly significant reduction in backfat ($p < 0.05$) are observed in PRIMOS 25-fed pigs

Table 9, - AD.G., F.C.R. and backfat thickness with PRIMOS at 0.1%

	PRIMOS 25	Control	p Value
	N = 6	N = 6	
Start weight (kg)	52.5 ± 4.7	52.0 ± 5.8	0.87
Final weight (kg) at 73 days old	111.7 ± 8.4	107.1 ± 8.9	0.38
A.D.G. (g)	811 ± 52	755 ± 54	0.10 (b)
F.C.R.	3.77	3.90	
Backfat thickness (cm)	1.3 ± 0.1	1.5 ± 0.1	0.02(a)

(a): highly significant at $p < 0.05$

(b); significant at $p < 0.1$

DISCUSSION & CONCLUSION

PRIMOS 25 is developed in the Republic of Singapore and is currently being sold as microbial mixed feed in Japan. The key feature of this product is the micro-encapsulation of *Lactobacilli* and *Saccharomyces* with oligosaccharide, which is assumed to allow the microbes to effectively reach the pig's intestinal flora, thereby exerting their beneficial effects and resulting in improved performance of pigs^{1) ii)}. This effect is expected to help in the reduction of the use of antibiotics as growth promotants.

The 4 trials conducted are not able to identify the way the microbes in PRIMOS 25 worked in pig's digestive organ. However, improvement in growth and feed efficiency with small dosages of PRIMOS 25, such as at 0.05% and 0.1%, are observed. This demonstrates the potential of PRIMOS 25 to reduce the feed cost for farmers. Furthermore, a significant effect in reducing the thickness of the backfat is observed. There is thus a potential to use PRIMOS 25 in Berkshire breed, which tends to have thicker and more rapid growth of the backfat.

Inspection of *Longissimus dorsi* shows a heightened meat-cutting strength in meat hardness index. This is assumed to be due to the rapid growth of the muscle fibres during growing phase of the pig. The increased meat hardness index has no significant impact on the meat taste inspection result.

There are farms in the Kagawa Prefecture facing excessive backfat issue, resulting in a lower carcass grading due to the use of soft floor panels. These trials show good indication for solving such a problem.

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