

Skjoldborg test station

TestGris***

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Effect of feeding concentrates containing different soy protein sources on productivity and health in weaned piglets

Test conducted on request of Agro Korn

August 19. 2016

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Resumé

Testen blev udført for Agro Korn i perioden 11. januar 2016 til 21 marts 2016 på Skjoldborg test station. Formålet med testen var at sammenligne effekten af tre forskellige sojaprotein-kilder (AlphaSoy 530 non-GMO, AlphaSoy 530 GMO og HP300) på den daglige tilvækst, foderoptagelse, foderudnyttelse, udtagne grise og medicinske behandlinger mod diarré.

Testen omfattede 3599 grise (Landrace/Yorkshire x Duroc) hvoraf ca. halvdelen var galtgrise og den anden halvdel sogrise. Grisene blev fravænnet og flyttet til klimastalden ved en alder på 25 ± 3 dage.

Ved fravæning blev grisene fordelt på 3 behandlinger og i perioden 0-14 dage (6-10 kg) fik de blandingerne AlphaSoy 530 non-GMO (6), AlphaSoy 530 GMO (6) og HP300 (6) (se Appendix C). I perioden 14-28 dage (10-16 kg) fik de blandinger AlphaSoy 530 non-GMO (10), AlphaSoy 530 GMO (10) og HP300 (10) (se Appendix D). Fra dag 28 (16-30 kg) fik alle grise samme foderblandning.

Resultaterne viste, at den daglige tilvækst var signifikant lavere ($P < 0,001$) hos grise, der fik HP300 i de første 4 uger efter fravæning sammenlignet med AlphaSoy 530 GMO (26 g/dag) og AlphaSoy 530 non-GMO (32 g/dag). Som resultat af forskellene i tilvækst vejede grisene der fik AlphaSoy 530 blandingerne gennemsnitlig 650 gram mere end dem, der have fået HP300 blandingerne på dag 28.

Resultaterne viste ingen effekt af foderblandingerne på foderoptagelse, foderudnyttelse, udtagne grise eller behandlinger mod diarré.

Summary

This study was conducted on request of Agro Korn in the period January 11 to March 21 2016 on Skjoldborg test station.

A total of 3599 crossbred (Landrace/Yorkshire x Duroc) female and castrated male piglets at approximately the same proportion were weaned at 25 ± 3 days of age.

The piglets were fed the test diets (AlphaSoy 530 non-GMO(6), AlphaSoy 530 GMO(6) or HP 300(6)) intended 6 to 10 kg pigs from the day of insertion in the climate stable until day 14 after insertion, followed by the diets (AlphaSoy 530 non-GMO(10), AlphaSoy 530 GMO(10) or HP 300(10)) intended 10 to 16 kg pigs from day 14 after insertion until day 28. From day 28 after insertion, the pigs were fed the same diet.

In conclusion average daily gain was significantly lower ($P < 0.001$) in piglets fed diet HP 300 at day 28 compared with piglets fed AlphaSoy 530 GMO (by 26 g per day) and AlphaSoy 530 non-GMO (by 32 g per day). At day 28 the difference between the HP 300 group and the AlphaSoy 530 groups had increased to 0.65 kg body weight.

No difference in feed conversion ratio was found at day 14 or 28.

No difference regarding piglet health was found from the day of insertion to day 28.

Introduction

The objective of the present study was to evaluate the effects of three soy protein sources on average daily gain (ADG), feed conversion ratio (FCR), pigs taken out (PTO) and diarrhoea related treatments (DRT) in piglets after weaning.

Materials and methods

The test was conducted at Skjoldborg teststation which is a commercial SPF sow herd giving birth to about 40,000 piglets a year.

A total of 3599 crossbred (Landrace/Yorkshire x Duroc) female and castrated male piglets at approximately the same proportion were weaned at 25 ± 3 days of age with an average body weight of 6.6 kg (SEM 1.2 kg).

The test used five similar rooms with 24 pens per room. Rooms were cleaned and disinfected before insertion of piglets. The pens were traditionally structured with one dry feed dispenser at the pen partition that feeds two pens, i.e. 12 dry feed dispensers per room. The piglets were group housed in pens (2.4 x 4.8 m) and allocated randomly; females and castrated males mixed on both sides of the feed dispenser. Thus, two pens around one feeder constitute one observation. This results in four replicates ($n=4$) per experimental group per room and 20 replicates ($n=20$) per group in total.

Around 30 piglets were inserted in every pen after weaning. Within a week unit, it was ensured, that there were the same number of piglets on the three test diets in every room.

The piglets were allocated to one of three diets: AlphaSoy 530 non-GMO(6), AlphaSoy 530 GMO(6) or HP 300(6) intended 6 to 10 kg piglets from the day of insertion in the stable until day 14 after insertion.

The diets AlphaSoy 530 non-GMO(10), AlphaSoy 530 GMO(10) or HP 300(10) intended 10 to 16 kg pigs was fed from day 14 until 28 after insertion. From day 28, all pigs were fed the same diet intended pigs with bodyweight 15 to 30 kg. All diets were fed *ad libitum*.

The diets were supplied when requested by a sensor in the individual feed dispenser up to several times per day. When requested and delivered to the individual feed dispenser, the amount of diet fed was registered by weight at feeding. The dry feed dispensers were adjusted daily to minimise feed waste.

The piglets had freely access to fresh water from nipple drinkers in the pens.

Concentrate AlphaSoy 530 non-GMO(6), AlphaSoy 530 GMO(6) and HP 300(6), and AlphaSoy 530 non-GMO(10), AlphaSoy 530 GMO(10) and HP 300(10), were optimised and delivered by Agro Korn in big bags. In accordance with the requests from Agro Korn, the diets were mixed at Skjoldborg test station.

The composition of the test diets and the reason for studying the diets were unknown for the personnel at the test station.

Test measurements

The piglets were weighed at the beginning of the experiment on day 0 and further on day 7, 14, 21 and 28.

The feed intake (FI) was recorded at day 14 and day 28 and corrected for the left-over feed in the dispenser. Number of dead piglets, PTO and DRT were monitored together with weight of pigs taken out of study.

Analysis

Experimental diets and concentrates were analyzed for dry matter (DM), crude nutrients, amino acid content, energy and phytase activity by LUFA-ITL GmbH (Agrolab Group).

All analyses were done by LUFA-ITL GmbH (Agrolab Group). One analysis per diet and concentrate was made.

Calculations and statistics

Average daily gain per piglet is calculated as the difference between weight at insertion in the test and weight at day 14 and day 28, i.e. when changing of diet and at the end of the test period, respectively. Weight at day 7 and 21 was also recorded.

Feed conversion ratio is the amount of feed intake per kg weight gain in piglets from day 0 to 14 and day 15 to 28.

All statistical analyses were done by Danish Technological Institute, Denmark. Animal performance data were statistically analysed by the GLMM procedure of R (R Core Team, 2014). Average daily gain at day 14 and 28, and FCR at day 14 and 28 were analysed in a gaussian mixed effect model including initial body weight, diet (AlphaSoy 530 non-GMO(6), AlphaSoy 530 GMO(6) and HP 300(6) or AlphaSoy 530 non-GMO(10), AlphaSoy 530 GMO(10) or HP 300(10)), room number and side of the room. Pigs taken out of study and DRT day 14 and 28 are not analysed due to too few registrations for analysis. Statistical significance was accepted at $P < 0.05$.

Results and discussion

No difference between diets was found regarding ADG at day 14 ($P < 0.19$), see Table 1.

At day 28, average daily gain was significantly lower ($P < 0.001$, Table 1) in piglets fed diet HP 300(10) compared with piglets fed diet AlphaSoy 530 non-GMO(10) (by 32 g/day) or AlphaSoy 530 GMO(10) (by 26 g per day).

Referring to the bodyweight curves these differences among groups are demonstrated, see Figure 1. Weight at day 0, 7, 14, 21 and 28 are presented as raw data in Table 2. At day 28 the difference between the HP 300 group and the AlphaSoy 530 groups had increased to 0.65 kg body weight.

No significant difference was found regarding FCR at day 14 ($P = 0.28$) or day 28 ($P = 0.17$), see Table 1.

The daily feed intake (FI) was slightly lower in diet HP 300 at day 14 and 28 compared with the diets AlphaSoy non-GMO and AlphaSoy GMO.

In general, piglets maintained good health during the experiment. No difference between number of dead piglets, PTO and DRT was found among experimental groups, data not shown.

The values of least significant difference (LSD) indicate that the study was scaled to identify differences in ADG of 0.014 to 0.018 kg per day and differences in FU of 0.038 to 0.065 kg/kg.

The presented data are based on the available statistical analyses from Danish Technological Institute and analyses of concentrates and diets, see Appendix A and B. On the basis of one analysis of each diet, the diets appear similar in content. Therefore, the reason for the lower ADG found at

day 28 in diet HP 300(10) compared to diet AlphaSoy 530 GMO(10) and AlphaSoy 530 non-GMO(10), is not immediately obvious.

Conclusion

In conclusion average daily gain was significantly lower ($P<0.001$) in piglets fed diet HP 300 at day 28 compared with piglets fed AlphaSoy 530 GMO (by 26 g per day) and AlphaSoy 530 non-GMO (by 32 g per day). At day 28 the difference between the HP 300 group and the AlphaSoy 530 groups had increased to 0.65 kg body weight.

No difference in feed conversion ratio was found at day 14 or 28.

No difference was found regarding PTO and DRT from the day of insertion to day 28.

Table 1. Average Daily Gain (ADG, g per day), Feed Intake (FI, g per day) and Feed Conversion Ratio (FCR; kg feed/kg gain) from day 0 to 14 and day 14 to 28 of pigs fed diet AlphaSoy 530 non-GMO, AlphaSoy 530 GMO or HP 300

	Day	AlphaSoy 530 non- GMO	AlphaSoy 530 -GMO	HP 300	P-value
ADG, g/d	14	239 ^a	234 ^a	224 ^a	0.19
	28	496 ^a	490 ^a	464 ^b	<0.001
FI, g/d	14	278	262	251	n. e.
	28	790	767	723	n. e.
FU, kg/kg	14	1.166 ^a	1.123 ^a	1.121 ^a	0.28
	28	1.592 ^a	1.566 ^a	1.559 ^a	0.17

^x Values are least squares means. (N=20).

^{a,b} Means within rows without a common superscript differ (P≤0.05).

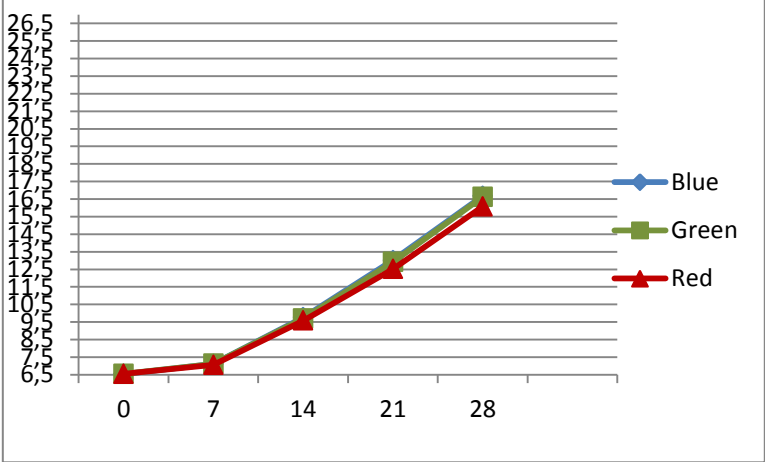
Table 2 Calculated average bodyweight (kg) of raw data, 95% Confidence Intervals (CI) day 0, 7, 14, 21 and 28 of pigs fed AlphaSoy 530 non-GMO, AlphaSoy 530 and HP 300

Period	Diet	LS-means	Lower 95%-CI	Upper 95%-CI	Diet group
Day 0	AlphaSoy 530 non-GMO(6)	6.535	5.919	7.152	a
	AlphaSoy 530(6)	6.550	5.933	7.166	a
	HP 300(6)	6.545	5.922	7.168	a
Day 7	AlphaSoy 530 non-GMO(6)	7.177	6.997	7.357	a
	AlphaSoy 530(6)	7.173	6.991	7.356	a
	HP 300(6)	7.107	6.925	7.289	a
Day 14	AlphaSoy 530 non-GMO(6)	9.875	9.642	10.109	a
	AlphaSoy 530(6)	9.816	9.576	10.056	a
	HP 300(6)	9.679	9.442	9.916	a
Day 21*)	AlphaSoy 530 non-GMO(6)	13.149	12.467	13.830	a
	AlphaSoy 530(6)	13.044	12.362	13.726	a
	HP 300(6)	12.620	11.936	13.304	b
Day 28 **)	AlphaSoy 530 non-GMO(6)	16.841	15.761	17.921	a
	AlphaSoy 530(6)	16.756	15.676	17.835	a
	HP 300(6)	16.207	15.125	17.289	b

*) Day 21: P=0,001219

***) Day 28. P= 0,000941

Figure 1. Calculated average bodyweight of raw data day 0, 7, 14, 21 and 28 of pigs fed diet AlphaSoy 530 non-GMO(6), AlphaSoy 530(6) and HP 300(6) shown as weight curve.



Appendix A. Chemical analysis of diet AlphaSoy 530 non-GMO(6), AlphaSoy 530 GMO(6) and HP 300(6), and AlphaSoy 530 non-GMO(10), AlphaSoy 530 GMO(10) and HP 300(10) intended 6 to 10 kg and 10 to 15 kg pigs^a

	AlphaSoy 530 non- GMO(6)	AlphaSoy 530 GMO(6)	HP 300(6)	AlphaSoy 530 non- GMO(10)	AlphaSoy 530 GMO(10)	HP 300(10)
Dry matter, %	9.7	9.9	10.3	11.9	11.9	12.0
Crude ash, %	5.6	5.3	5.2	5.6	5.6	5.4
Crude protein (N*6.25), %	19.8	19.8	19.7	18.0	18.0	17.9
Total fat, %	6.4	5.6	5.7	3.9	6.0	6.1
Crude fibre, %	2.3	2.2	1.8	2.6	2.7	2.7
N-free substances, %	56.2	57.2	57.3	58.0	55.8	55.9
EFOS, %	94.1	94.1	92.3	89.7	90.5	90.4
EFOSi, %	87.8	87.1	87.1	84.1	84.5	83.9
FEso/100kg	124	122	121	111	116	116
FEsv/100kg	126	124	123	112	117	117
Ca, g/kg	8.7	8.3	7.7	10.4	10.1	10.0
P, g/kg	6.6	6.5	6.6	6.4	6.6	6.3
Na, g/kg	1.7	1.6	1.8	2.5	2.2	2.2
Cu, mg/kg	150	146	165	174	122	131
Fe, mg/kg	341	301	302	363	328	363
Zn, mg/kg	388	322	306	223	176	169
Lys, g/kg	14.8	15.1	13.9	13.8	14.6	13.8
Met, g/kg	4.7	4.8	4.1	4.2	3.9	4.3
Cys, g/kg	3.1	3.3	3.1	3.2	3.0	3.1
Thr, g/kg	9.7	9.6	8.7	8.8	8.8	8.9
Val, g/kg	8.4	8.7	8.0	8.2	8.8	8.8
Trp, g/kg	2.9	2.9	2.7	2.6	2.6	2.5
Phytase activity, FTU/kg	673	1220	1070	927	835	822

^a All analysis were done by LUFA. All parameters are based on a dry matter basis. n=1

Appendix B. Chemical analysis of concentrates AlphaSoy 530 non-GMO(6), AlphaSoy 530 GMO(6) and HP 300(6), and AlphaSoy 530 non-GMO(10), AlphaSoy 530 GMO(10) and HP 300(10) intended 6 to 10 kg and 10 to 15 kg diets^a

	AlphaSoy 530 non- GMO(6)	AlphaSoy 530 GMO(6)	HP 300(6)	AlphaSoy 530 non- GMO(10)	AlphaSoy 530 GMO(10)	HP 300(10)
Dry matter, %	5.4	5.3	5.7	6.7	6.5	6.5
Crude ash, %	9.7	10.2	10.1	16.3	16.8	18.0
Crude protein (N*6.25), %	33.4	34.8	34.4	33.8	36.4	35.7
Total fat, %	11.0	9.6	10.3	19.7	17.5	19.0
Crude fibre, %	1.8	1.9	1.7	1.8	1.8	2.1
N-free substances, %	38.7	38.2	37.8	21.7	21.0	18.7
Ca, g/kg	18.0	18.3	17.5	38.4	43.7	42.7
P, g/kg	11.3	11.4	11.3	16.3	16.8	17.2
Na, g/kg	3.5	3.7	4.1	9.6	9.0	8.5
Cu, mg/kg	337	320	363	541	533	548
Fe, mg/kg	477	635	530	1030	1330	1230
Zn, mg/kg	322	293	295	573	615	605
Cys, g/kg	4.8	4.9	5.1	4.4	4.6	4.6
Lys, g/kg	29.5	29.9	29.9	35.5	37.3	38.6
Met, g/kg	9.0	8.5	8.6	7.7	8.2	8.3
Thr, g/kg	17.9	18.6	18.5	20.0	22.2	22.0
Trp, g/kg	5.1	5.3	5.3	5.2	5.6	5.8
Val, g/kg	16.4	17.1	17.2	16.6	18.5	17.9
Phytase activity, FTU/kg	701	<200	869	431	<200	279

^a All analysis were done by LUFA. All parameters are based on a dry matter basis. n=1

Appendix C. Composition of 6 to 10 kg test diets (g/kg, as-fed basis)

Diet groups	AlphaSoy 530 non-GMO(6)	AlphaSoy 530 GMO(6)	HP 300(6)
Wheat	523	537	553
Barley	50	50	50
AlphaSoy 530 non-GMO	159	0	0
AlphaSoy 530 GMO	0	145	0
HP 300	0	0	129
AlphaSoy Premium	30	30	30
Potato protein	20	20	20
DanMilk Ideal	50	50	50
Whey powder	86	86	86
Vitamin + minerals premix, incl. organic acids, oils & fats	82	82	82

Appendix D. Composition of 10 to 16 kg test diets (g/kg, as-fed basis)

Diet groups	AlphaSoy 530 non-GMO(10)	AlphaSoy 530 GMO(10)	HP 300(10)
Wheat	531	535	543
Barley	150	150	150
AlphaSoy 530 non-GMO	102	0	0
AlphaSoy 530 GMO	0	98	0
HP 300	0	0	90
Soybean meal	100	100	100
Potato protein	20	20	20
Vitamin + minerals premix, incl. organic acids, oils & fats	97	97	97

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