DANBRED DUROC CROSSBRED FINISHERS GROW FASTER THAN PIETRAIN CROSSBREDS

TRIAL REPORT NO. 1154

Daily gain was 142 g higher and lean meat % in carcasses 2.0% lower in DanBred Duroc offspring compared with Pietrain offspring. Daily gain in the 7-30 kg period was 21 g higher in DanBred Duroc pigs.

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Abstract

It is crucial that DanBred pig producers are able to produce finishers with the largest profit possible under conditions that benefit animal welfare and comply with environmental requirements. The aim of this trial was to determine differences in productivity in finishers between the traditional Danish DLY crossbreds (DanBred Duroc x LY) and PLY (Pietrain x LY) crossbreds.

Crossbred piglets were produced in a conventional sow herd. The sows were inseminated in the period May 2015 to January 2017. Post-weaning, the trial pigs were moved to Grønhøj trial station.

In the 35-110 kg growth period, the pigs were fed via automatic feeders that recorded individual feed intake. The trial comprised a total of 210 female pigs of each crossbreed.

Results showed that, when based on carcass weight, DLY pigs gained 142 g/day more than PLY pigs: DLY gained 1,059 g/day vs 917 g/day in PLY. Lean meat percentage in carcasses was 2.0% lower in DLY vs PLY: 61.8% vs 63.8%. Calculated on the basis of live weight the day before slaughter, FCR was 0.14 FUgp/kg lower in DLY compared with PLY, but as DLY pigs have a higher dressing loss

there were no differences in FCR between the two crossbreeds, calculated on the basis of carcass weight.

Background

It is crucial that DanBred pig producers are able to produce finishers with the largest profit possible under conditions that benefit animal welfare and comply with environmental requirements. For decades, the combination of Duroc boars and Landrace and Yorkshire hybrid sows (DLY) has been the preferred combination in Denmark and is still the one used by most Danish pig producers today. In some European countries, however, in particular in Germany, Spain, France, Belgium and the Netherlands, many pig producers use Pietrain as sire line. Pietrain is a popular breed known for a high lean meat percentage, and some slaughterhouses pay an extra bonus for finishers if pig producers are able to prove that they are sired by Pietrain boars. In other European countries, Duroc boars are preferred as sire line, particular in Italy where the production of prosciutto is contingent on Duroc boars being used as sires.

Duroc is known for a high daily gain and a supreme meat quality with intramuscular fat, and Pietrain is known for a high lean meat percentage in carcasses (Edwards et al, 2006, Edwards et al, 2003, Kušec et al, 2004). In Denmark, possible benefits in using other sire lines have previously been discussed. However, research has repeatedly confirmed that Duroc sires, Landrace and Yorkshire sows is the best and cheapest combination in finisher production (Nielsen et al, 2001, Udesen et al, 1996). Nevertheless, development in production conditions and genetic progress may challenge this conclusion. In recent years, the export of weaned pigs from Denmark to Germany and Poland has increased, which in turn has increased the need for more knowledge of the consequences of using Pietrain as sire line.

The aim of this trial was to establish the differences in daily gain, FCR and lean meat percentage in offspring from LY sows inseminated with semen from either the traditional DanBred Duroc boar or a Pietrain boar.

The trial was designed to reject or confirm three hypotheses:

- PLY gain is minimum 35 g/day higher or lower than DLY gain
- FCR in PLY is minimum 0.05 FUgp/kg higher or lower than in DLY
- Lean meat percentage in PLY carcasses is minimum 1% higher or lower than in DLY carcasses.

Materials and method

The pigs were produced in the supplier herd where sows were inseminated in the period May 2015-January 2017. Twenty sows were randomly selected for insemination with semen from either DanBred Duroc boars (DLY) or German Pietrain boars (PLY), and this was repeated five times in the above-

mentioned period. Every week when sows were inseminated, semen from 2-3 boars of each breed was used. On a weekly basis, sows were randomly assigned to one of the two groups. The DanBred Duroc boars were randomly selected at AI station Hatting in Horsens. The Pietrain semen was selected from semen doses delivered by one of Boar Station Mors' German partners (German Pietrain). Throughout the trial period, minimum two sows were inseminated with semen from each boar. The trial comprised 40 boars of each breed and they produced approx. six offspring from two sows each for the trial.

After birth, the trial pigs, female pigs only, were randomly selected among all DLY and PLY female pigs and individually ear-tagged, and this ID followed the pigs from birth to slaughter whereby the parents' ID was also known. Post-weaning, the pigs were moved to Grønhøj where they stayed first in the weaner unit and then the finisher unit. Daily gain until transfer to the finisher unit (Daily gain 1 – table 3) was calculated by dividing weight by age at transfer where birth weight was set to 0 for all pigs. Once in the finisher unit, the trial pigs were accommodated in pens with automatic feeders. Each pen housed 14 pigs, and all pigs in one pen were of identical origin. Automatic feeders (Schaur) recorded the daily feed intake of each pig from around 35 kg until slaughter. To keep the random variation in this trial to a minimum, only female pigs were used as the differences within breed between female pigs, male pigs and castrates are assumed to be known for the traits studied in this trial.

The trial comprised a total of 210 female pigs per crossbreed combination. Weight and feed intake were recorded for each pig in the period approx. 35 kg until slaughter. As PLY pigs have shown a lower daily gain than DLY pigs, a rotation (35-110 kg) lasted 16 weeks versus the usual 13 weeks to ensure that all pigs were slaughtered at almost identical live weights.

All litters, regardless of origin, were given the same feed: pelleted dry feed ad libitum. The feed complied with the Danish recommendations and consisted of: barley (37.0%), wheat (37.6%), soybean meal (10.4%), sunflower meal (9.0%) and vitamin/mineral premixes (appendix 1). The feed contained 128.5 g protein per FUgp[1], 7.82 g digestible lysine per FUgp and 1.05 FUgp/kg, which was the value used to calculate feed intake and feed conversion ratio. Feeding accuracy was routinely monitored.

The pigs were assigned an individual ID before slaughter. The day before slaughter each pig was weighed. At the slaughterhouse, carcass weight and lean meat percentage were individually recorded for each pig. Data from the routine recordings made at the slaughterhouse were also used in the analyses.

Calculation of daily gain and feed conversion ratio (FCR) was based on live weight and on carcass weight multiplied by a factor for loss at slaughter of 1.31. Carcass weight is used as the basis for

[1] 1.07 FUgp = 13.4 MJ NE = 9.6 MJ NE = 7.9 MJ physiological energy

calculating daily gain and FCR in Denmark i.e. the value of the carcass, and not live weight at slaughter, as is the case in other countries, forms the basis of the settlement between slaughterhouse and pig producer. Individual weight data was also used to determine the dressing loss for the two crosses.

Statistics

All variables were subject to analysis in a generalised linear model with the covariates: litter origin, trial round, start weight, and random effect of boar (father) and sow (mother). The model:

$$y_{ijklm} = \alpha_i + \beta_j + a * w0_{ijklm} + s_k + d_l + \varepsilon_{ijklm}$$

where $y_{ijklm}$is the analyzed response, α_i is the effect of the two crosses, β_j is the effect of the five inseminations, a is regression coefficients for the start weight $w0_{ijklm}$ of each individual pig, s_k is the effect of the boar (father), d_l is the effect of the sow (mother), which is nested within boar as one sow only contributes with one litter. The effect ε_{ijklm} is the random and independent residual effect. For all random effects, the following applies: $s_k \sim n(0, \sigma_s^2)$, $d_l \sim n(0, \sigma_d^2)$ and $\varepsilon_{ijklm} \sim n(0, \sigma_\varepsilon^2)$.

Results and discussion

Table 1. Trial design (number of pigs)

	DLY	PLY
Fathers	40	40
Litters	122	111
Female pigs born	340	314
Trial pigs	210	210
Dead	2	11
Culled to hospital pen	13	9
Inadequate ID slaughter house	3	3
Live pigs weighed the day before slaughter *	177	190
Slaughter data	192	187

*) Data from one batch is missing

Table 2. Disease recordings (number of pigs)

	DLY	PLY
Diarrhoea	31	1
Other diseases	2	13

The trial comprised 210 pigs per crossbreed combination. Some pigs were culled from the trial due to disease or death (table 2), and three pigs of each cross failed to be identified at the slaughterhouse (table 1). 15 DLY pigs and 20 PLY pigs either died or were culled from the trial (table 1). Results revealed no differences in treatments for diarrhoea and culled/dead pigs between the two crosses.

Determination of differences in these factors would have required a significantly larger trial and significantly more offspring per boar.

Table 3. Production results. Weighted average of DLY and PLY, difference between the crosses, variances related to father, mother and variance residual and P value based on fathers. Daily gain and FCR values are corrected for differences in start weight.

	DLY	PLY	Diff.	Variance boar	Variance sow	Variance residual	P value breed
Weight at transfer to finisher unit, kg	36.6	34.7	1.9	18.9	4.3	13.7	0.080
Age at transfer, days	83.3	82.7	0.6	47.2	8.4	3.0	0.690
Daily gain I, g/day	440	419	21	690	580	1,890	0.010
FCR, FUgp/day	2.68	2.34	0.34	0.002	0.01	0.08	<0.001
Based on live weight the day before slaughter							
Weight, kg	117.2	115.0	2.2	1,5	0.8	19.0	<0.001
Daily gain II, g/day	1,064	887	177	2,773	0.0	6,679	<0.001
FCR, FUgp/kg	2.58	2.72	-0.14	0.01	0.00	0.030	<0.001
Based on carcass weight *1.31							
Daily gain III, g/day	1,059	917	142	1,111	553	6,050	<0.001
FCR, FUgp/kg	2.60	2.63	-0.03	0.003	0.004	0.024	0.200
Lean meat %	61.8	63.8	-2.0	0.46	0.93	2.69	<0.001
Carcass weight*, kg	88.2	89.9	-1.7	0.21	-	10.8	<0.001

Daily gain I = gain from birth to transfer to the finisher unit

Daily gain II = gain from transfer to the finisher unit to the day before slaughter

Daily gain III = gain from transfer to the finisher unit until slaughter

* Variance insufficient to be able to estimate a boar and a sow variance

Table 4. Estimated regression coefficients (a) and standard deviations corrected for weight at transfer to the finisher unit

	a	SD	P value
Feed intake, FUgp/day	0.019	0.003	<0.0001
Live weight at slaughter, kg	0.05	0.05	0.30
Daily gain II, g/day	2.13	1.07	0.05
FCR, FUgp/kg	0.006	0.002	0.006
Daily gain III, g/day	2.30	1.00	0.02
FCR, FUgp/kg	0.006	0.002	0.005

Daily gain II = gain from transfer to the finisher unit to the day before slaughter

Daily gain III = gain from transfer to the finisher unit until slaughter

DLY pigs tended (P=0.08) to weigh more at transfer to the finisher unit compared with PLY: 36.6 kg vs 34.7 kg (table 3), respectively. This is likely attributed to a lower gain in PLY in the 7-30 kg period as age at transfer to the finisher unit was identical for both crosses. Daily gain until transfer to the finisher unit (Daily gain I – table 3) was 21 g/day higher for DLY compared with PLY.

Looking at live weight at slaughter and correction for variations in weight at transfer to the finisher unit, DLY pigs had a significantly higher daily gain ($P<0.0001$) from approx. 35 kg until slaughter compared with PLY pigs. DLY pigs had an average daily gain of 1,064 g/day vs 887 g/day for PLY, based on live weight (table 3), which is a difference of 177 g/day. FCR was 0.14 FUgp/kg lower for DLY pigs compared with PLY ($P<0.0001$) if based on live weight.

Looking at carcass weight and correction for variations in weight at transfer to the finisher unit, daily gain was 142 g/day higher for DLY pigs compared with PLY pigs. This corresponds to PLY pigs requiring 12 more days than DLY to go from 35 kg live weight to 90 kg carcass weight. This is due to the fact that DLY pigs need (1.31*90 kg – 35 kg) / 1,059 g/day = 78 days, while PLY pigs need (1.31*90 kg – 35 kg) / 0.917 kg/day = 90 days to reach the same carcass weight.

For several traits, variations between boars (sires) were greater than between sows (mothers), cf. table 3. This is normally not the case, as the sow usually impacts the offspring more than the boar does. In this trial, variations between boars were the central element, and the trial was therefore designed to analyze variations between boars and not between sows. When a pig producer chooses crossbreed combinations for the production, they choose between different boar lines. Consequently, differences between crosses must be evaluated according to the random difference between the boars used (sires).

The value of gain found in this trial applies under the prerequisites of the trial. Pigs were moved to the finisher unit at an average weight of 36.6 kg for DLY and 34.7 kg for PLY pigs (table 3). The estimated coefficient of 2.3 (g/day) / kg corrects for variations in start weight (table 4). For a 30 kg pig, gain drops by 2.3*(((36.6+34.7) / 2) -30) = 13.0 g/day if the pig is transferred at 30 kg. The calculated drop in gain, assuming the pigs weighed 30 kg at transfer, is identical for both crosses.

The difference in daily gain between DLY and PLY was greater in this trial than previously found. In an American trial, DLY and PLY pigs were slaughtered after 26 weeks at an average slaughter weight of 108.0 kg and 103.0 kg (Edwards et al., 2003 & Edwards et al., 2006). Danish research previously demonstrated a difference between DLY and PLY of 98 g/day in the period from 30 kg until slaughter at roughly 100 kg live weight (Nielsen et al 2001).

Average daily feed intake was higher for DLY pigs compared with PLY pigs (figure 1).

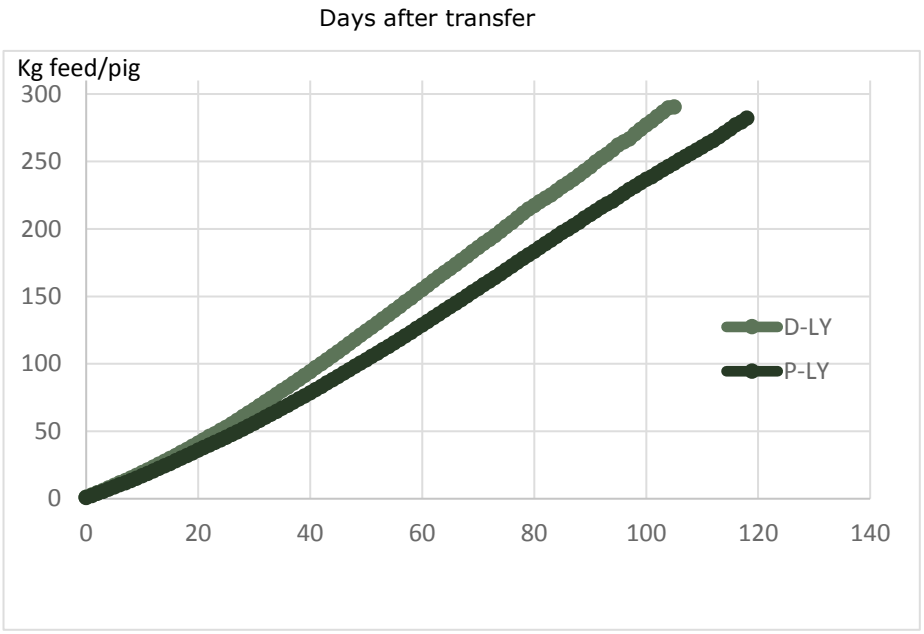

Figure 1. Accumulated feed intake, dry feed ad lib, calculated as an average per pig per cross relative to days after transfer to the finisher unit.

Based on carcass weight, FCR was identical in both groups: DLY: 2.60 FUgp/kg and PLY: 2.63 FUgp/kg, which is not significant (table 3). In both crossbreed combinations, the factor for loss at slaughter of 1.31 is used to calculate live weight based on carcass weight. Compared with the results based on live weight, the difference between the two crossbreed combinations in both gain and FCR drops, because dressing loss was higher in DLY than in PLY (24.8% vs 21.9%), corresponding to a dressing loss factor of 1.33 vs 1.28.

Live weight at slaughter was 2.2 kg higher for DLY pigs compared with PLY pigs, while DLY carcass weight was 1.7 kg lower than PLY. This also shows the difference in dressing loss between the two crosses (table 3).

Lean meat percentage in carcasses was 2.0 percentage points (significant) lower in DLY compared with PLY (table 3): 61.8% vs 63.8%. Autofom 3 was used for classification, which is routine procedure at Danish slaughterhouses today. This equipment is calibrated to Danish finishers (DLY) and does therefore not consider the fact that meat distribution may differ between breeds. Had different a procedure been used, such as CT scanning, it might have affected the difference. Previous research showed a smaller, not significant difference in lean meat percentage between DLY and PLY when the pigs were slaughtered at 115 kg live weight (Nielsen et al., 2001).

Evaluation of data and model

Analysis of the production traits recorded in this trial revealed a few pigs with extreme values (figure 2) both in data from live pigs and in slaughterhouse data. This is illustrated in data for FCR based on

carcass weight: the best DLY pigs had an FCR of 1.58 FUgp/kg and the poorest up to 3.38 FUgp/kg (figure 2). Such extreme observations seem biologically improbable and must be attributed to inadequate recording either in the stable or at the slaughterhouse. However, the observations are not significantly different and lie within the random variations observed in this trial. Exclusion of these extreme observations from the data set would not affect the conclusions of this trial, and they were therefore maintained as part of the data in the statistical analysis.

Residual plots of the individual traits are not shown in this trial report. All residual plots showed that the assumptions of normal distribution of residuals were present, and there were no indications of deviations within individual observations.

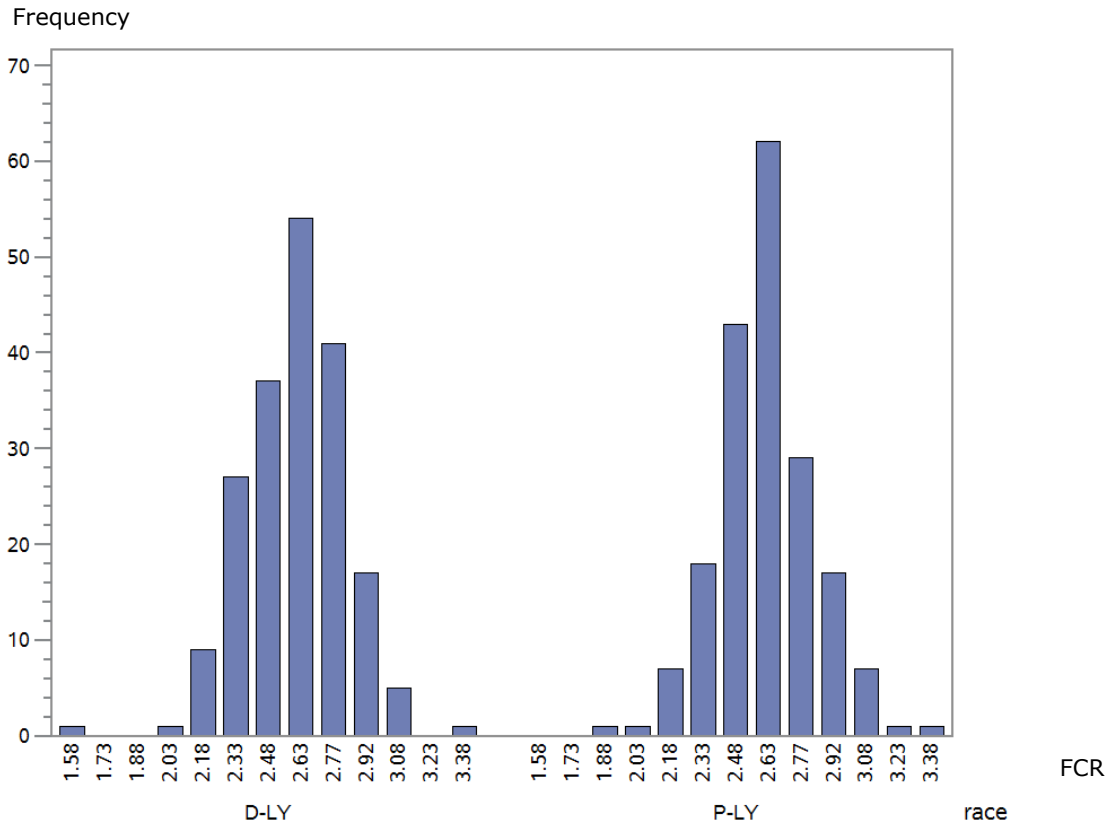

Figure 2. Feed conversion ratio (FUgp/kg) in DLY and PLY pigs based on individual feed intake and carcass weight multiplied by 1.31.

Conclusion

Daily gain until transfer to the finisher unit was 21 g/day higher in DLY pigs compared with PLY pigs. In the 30-110 kg period, DLY pigs gained 142 g/day more than PLY pigs. Data showed no difference in feed conversion ratio between the two crosses when FCR was based on carcass weight. Lean meat percentage was 2% lower in DLY than in PLY.

References

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Participants

Technical assistance: Per Mark Hagelskjær

Trial no. 1423

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Appendix 1

Composition of the diet used in the trial

Ingredients, % of diet

Ingredient	%
Wheat	37.60
Barley	37.00
Wheat bran	0.60
Sunflower seed meal, dehulled	9.00
Sunflower seed meal, dehulled, toasted	10.37
Sugar beet molasses	1.00
Palm oil	1.20
Mono calcium phosphate	0.43
Calcium carbonate	1.46
Salt	0.47
Lysine	0.51
Methionine	0.03
Threonine	0.11
Vitamins DA vit. SL	0.20
Ronozyme HiPhos	0.03

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