THE PERFORMANCE OF PUREBRED AND CROSSBRED SOWS

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Summary

The data on reproductive performance of 1065 purebred Landrace, 1254 purebred Yorkshire, 553 purebred Duroc and 327 purebred Pietrain sows bred to farrow purebred litters and data from 3413 Landrace × Yorkshire, 487 Duroc × Pietrain and 3191 commercial litters were used in this study. The data were collected from litters farrowed from January 1986 to December 1988 in Holiday Hills Stock and Breeding Farms, San Pedro, Laguna.

The crossbred sows and litters were better in most traits associated with sow productivity than their contemporary purebred sows and litters. The Duroc × Pietrain crossbred litters showed 16.67 % improvement in litter size at weaning, 10.11% improvement in survival rate from birth to weaning and 16.21% more pigs per sow per year than the averages of their parental breeds. The litters from the Landrace × Yorkshire crossbred sows sired by either Duroc or Doroc × Pietrain boars had 11.01% bigger litter size at birth, 20.74% increase in litter size at weaning and 22.86% more pigs weaned per sow per year than the averages of the four parental breeds. Very little improvement in most traits evaluated were observed from the Landrace × Yorkshire crossbred litters compared with their parental breeds.

Year of birth of litter had little influence on sow productivity. However, the reproductive performance declined when sows farrowed in June up to September. The best months of farrowing were found to be from January to April. The breed × year, breed × month and year × month had no significant effects on all traits evaluated.

(**Key Words**: Crossbred Sow, Litter Size, Reproductive Performance, Heterosis)

Introduction

It is already common knowledge among swine raisers throughout the world that crossbred are better than purebred sows. However, very few Filipino pork producers have taken full advantage of this proven technology, probably because all published reports on this particular topic have originated from other countries (Fabbri and Bergonzini, 1981; Gaugler et al., 1984; Johnson, 1981; Jung and Park, 1982; MacBeth, 1987; Park and Kim, 1983 and Sokolov et al., 1988). Even the recommendations made by Filipino experts and extension workers along this subject were also based on information from abroad.

This study was conducted to compare the reproductive performance of purebred and crossbred sows under Philippine conditions.

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Materials and Methods

The data used in this study were taken from the breeding and production records of the purebred and crossbred sows in Holiday Hills Stock and Breeding Farms, San Pedro, Laguna. The nucleus herd of this farm was started sometime in 1976. Young boars and gilts were imported from United Kingdom, United States, Holland, Denmark, Switzerland and Germany in 1977 and 1978. The production performance of these imported animals was reported by Arganosa et al. (1979a, b). The reproductive and productive performance of the progenies of these imported animals were reported by Arganosa (1985, 1986), Arganosa et al. (1985a,b; 1986), Rivas et al. (1984), Napoles et al. (1986) and Siagian et al. (1986).

Purebred Landrace, Yorkshire, Duroc and Pietrain were maintained through a planned breeding program to minimize inbreeding. Replacement breeding animals were selected on the basis of production performance and conforma-

tion. All potential breeding animals weighing from 25 to 30 kg to around 90 kg were put on performance test to measure average daily gain, feed efficiency and backfat thickness. The general physical appearance of the animals including body length, muscle development, traits associated with reproduction, and strength and placement of legs were subjectively evaluated. The best performing and good looking boars and gilts at around 90 kg were brought to the nucleus herd for purebreeding. The second best and excess animals for purebreeding were used in a crossbreeding program to produce F1 replacement boars and gilts.

Purebred Landrace sows were bred to purebred Yorkshire boars and vice versa to produce F1 sows. Purebred Duroc sows were bred to purebred Pietrain boars and vice versa to produce the F1 boars. The F1 sows were bred to either purebred Duroc or F1 boars to produce the market hogs.

Furthermore, almost all purebred sows after farrowing four litters even with still good performance were removed from the purebred herd and were used for the production of crossbred animals. Senior boars were almost always replaced as soon as their progenies with better performance became available to take over. Very little selection pressure had been exerted on traits associated with sow productivity.

The reproductive performance of all purebred sows that farrowed purebred and crossbred litters and the F1 sows were compared. The data were gathered from all sows that farrowed from January 1986 to December 1988. The average monthly performance of each breed-group was considered the experimental unit and was used in the analysis of the data. Each breed-group had 36 observations (12 months × 3 years) giving a total of 252 observations for all seven breed-groups. The data were analyzed using year, month and breed-group as sources of variations in a completely randomized design with equal number of observations. The means were compared using the Duncan Multiple Range Test (DMRT).

Results and Discussion

The number of litters farrowed by each breed-group in the different months and years are presented in table 1. There were 1065 purebred Landrace (L), 1254 purebred Yorkshire (Y), 553 purebred Duroc (D), 327 purebred Pietrain (P), 3413 Landrace × Yorkshire (LY), 487 Duroc

TABLE 1. NUMBER OF LITTERS FARROWED IN EACH YEAR AND BY EACH BREED-GROUP IN THE DIFFERENT MONTHS

Month	Breed group							Year			Total
	Landrace (L)	Yorkshire (Y)	Landrace × Yorkshire (LY)	Duroc (D)	Pietrain (P)	Duroc × Pietrain (DP)	Commercial Breed (C)	1986	1987	1988	
Jan	81	115	293	48	19	39	236	261	289	281	831
Feb	101	156	294	58	22	48	256	323	277	335	935
Mar	112	122	287	65	46	40	264	329	286	321	936
Apr	72	99	267	49	25	42	230	279	265	240	784
May	92	100	315	58	25	45	283	238	311	369	918
Jun	96	87	311	48	31	46	266	241	336	308	885
Jul	88	121	289	44	31	39	292	322	307	275	904
Aug	76	96	267	43	30	44	286	262	234	346	842
Sep	86	62	198	25	23	26	182	198	203	201	602
Oct	92	93	303	38	22	54	317	210	306	403	919
Nov	73	85	280	32	16	33	286	238	310	257	805
Dec	96	118	309	45	37	31	293	234	320	375	929
Total	1065	1254	3413	553	327	487	3191	3135	3444	3711	10290

TABLE 2. THE EFFECTS OF BREED-GROUP ON THE DIFFERENT TRAITS

Trait	Breed-group[1]								
	Landrace (L)	Yorkshire (Y)	Landrace × Yorkshire (LY)	Duroc (D)	Pietrain (P)	Duroc × Pietrain (DP)	Commercial Breed (C)	Overall Average	G.E.
Litter size at weaning									
Born alive	8.64[b]	8.90[ab]	8.85[ab]	7.34[d]	7.73[c]	7.98[c]	9.05[a]	8.35	0.11
Born dead	0.23[c]	0.29[b]	0.29[b]	0.40[a]	0.36[ab]	0.29[b]	0.30[b]	0.31	0.04
Total born	8.87[b]	9.19[ab]	9.14[ab]	7.73[d]	8.09[c]	8.27[c]	9.35[a]	8.66	0.11
Percent stillborn (%)	2.67[d]	3.14[cd]	3.16[cd]	5.18[a]	4.36[ab]	3.65[bc]	3.42[bcd]	3.65	0.42
Litter size at weaning	7.81[b]	8.04[ab]	8.19[a]	5.86[a]	6.02[d]	6.93[c]	8.37[a]	7.32	0.13
Percent weaning based on									
Total born	87.92[a]	88.13[a]	89.66[a]	75.26[c]	74.57[c]	83.43[b]	89.39[a]	84.05	1.23
Pigs born alive	90.27[a]	91.26[a]	92.49[a]	79.39[c]	77.89[c]	86.59[b]	92.57[a]	87.21	1.20
Weaning age (days)	26.96	30.02	30.04	29.33	36.75	29.93	30.02[a]	30.94	2.66
Weaning weight (kg)[2]	7.04[a]	6.79[b]	7.00[a]	6.26[c]	6.27[c]	6.75[b]	7.09[a]	6.74	0.06
Gestation period (days)	115.13	114.33	114.87	114.08	115.26	114.37	114.56	114.39	1.08
Interval between weaning and conception (days)	18.32	18.59	15.59	17.86	19.07	20.34	16.30	18.01	1.14
Interval between two farrowings (days)	168.71	164.51	160.96	161.90	165.21	164.50	160.71	163.07	1.18
Farrowing rate (%)	76.82[ab]	78.78[a]	77.65[ab]	73.92[b]	66.58[c]	68.21[c]	79.19[a]	74.45	1.58
Farrowing index	2.24	2.23	2.27	2.26	2.22	2.23	2.28[a]	2.25	0.02
Pigs weaned per sow per year	17.45[c]	18.02[bc]	18.59[ab]	13.23[e]	13.29[e]	15.41[d]	19.04[a]	16.43	0.30
First litter farrowed	31.22	31.09	21.78	30.95	33.64	39.33	31.36	31.34	3.04

[1] Means followed by the same litters are not significantly different at $p<.05$

[2] Adjusted to 30 days old at weaning

× Pietrain (DP) and 3191 commercial (C) litters farrowed during the period of observations. There were 3135, 3444 and 3711 litters farrowed in 1986, 1987 and 1988, respectively for a total of 10290 litters. The highest number of litters farrowed on a monthly basis was 151 by the Landrace × Yorkshire breed-group in October 1988.

The effects of breed-group on the different traits are presented in table 2. The Landrace × Yorkshire sows mated to the terminal boars farrowed the biggest litter size born alive. The commercial litters averaged 9.05 pigs born which was significantly higher than the purebred Landrace, Duroc, Pietrain and DP litters. The purebred Duroc litters averaged only 7.34 pigs born alive which was significantly smallest among the seven breed-groups. The purebred Duroc litters likewise registered the highest average stillborn pig and mummified fetuses equivalent to 0.40 head or 5.18%. These Duroc averages were significantly higher than those farrowed by the purebred Landrace and Yorkshire sows and similar to those registered by the purebred Pietrain.

The average litter sizes of 8.87 pigs for the Landrace, 9.19 pigs for the Yorkshire, 7.73 pigs for the Duroc and 8.09 pigs for the Pietrain were much smaller than those reported from other countries (Fabbri and Bergonzini, 1981). These averages were also much smaller than what have been reported by Siagian et al. (1986) for the Landrace and Yorkshire and about the same as those reported by Arganosa et al. (1988) for the Duroc and Pietrain from the same station.

The average stillborn pigs and mummified fetuses were 0.31 head equivalent to 3.65%. These figures are very much lower and better than the previous reports (Arganosa et al., 1981; Siagian et al., 1986).

The Duroc registered the highest number of stillborn pigs with 0.40 or 5.18%. This is significantly higher than those farrowed by the Landrace, Yorkshire and the Landrace × Yorkshire crossbred sows.

The overall average litter size at weaning was 7.32 pigs. The commercial sows produced the largest litter size at weaning of 8.37 pigs which were significantly bigger than those weaned by the colored sows and the Landrace. The purebred Yorkshire and the white crossbred litters were slightly smaller than the litters of the commercial sows.

The commercial sows registered the highest survival rate of pigs from birth to weaning of 92.57% based on pigs born alive. This average was slightly higher than the performance of the other white sows but significantly higher than the colored sows. Likewise, the average weight of the pigs at weaning from the commercial sows was heavier than those weaned by the colored sows. These data clearly demonstrate that the purebred Landrace and Yorkshire sows and their crossbred litters and the crossbred sows are better than the purebred Duroc and Pietrain and their crossbred litters in terms of litter size at birth and at weaning, survival rate of pigs from birth to weaning and the weight at weaning.

The different breed-groups had essentially the same gestation period averaging 114.39 days, with interval of 18.01 days from weaning to conception, with 163.07 days interval between two consecutive farrowings and a farrowing index of 2.25. However, the commercial sows registered the highest average farrowing rate of 79.19%, slightly better than the other white sows but significantly higher than the colored sows. The average farrowing rate of 74.45% was much higher than the 69.9% previously reported by Arganosa et al. (1977) but lower than averages reported by Rigor et al. (1987) and Arganosa et al. (1979c).

The average farrowing index was 2.25. There were no differences found in this trait among the different breed-groups. However, with the significant differences in the average litter size at weaning, the number of pigs weaned per sow per year was significantly different. The commercial sows weaned an average of 19.04 pigs per year followed by 18.59 pigs for the LY litters. The Duroc and Pietrain sows weaned significantly fewer pigs per sow per year than the other breed-groups.

The percentage heterosis was computed by dividing the difference between the average of the crossbred pigs by the average of the parental breeds multiplied by 100. The percentage heterosis realized for the selected traits are presented in table 3. Very small percentage improvement was found in most traits asssociated with sow productivity as exhibited by the crossbred litters compared with the average of the parental breeds of Landrace and Yorkshire. Those two breeds

were known to have good mothering abilities and they have been equally recommended to be included in the development of sow lines. These two breeds have many things in common such that not much heterosis was observed.

On the other hand, the Duroc × Pietrain crossbred litters exhibited very high percentage heterosis. The crossbred litters showed 16.67% improvement in litter size at weaning, 10.11% improvement in survival rate from birth to weaning, 7.74% heavier weaning weight and 16.21% more pigs weaned per sow per year compared with the averages of the parental breeds. The Duroc used in this study were mostly of American origin while the Pietrain originated from Germany. These two breeds were different in their type and average reproductive performance as reported by Arganosa et al. (1988).

The litters produced by the commercial sows with either the Duroc or Pietrain × Duroc ter-

TABLE 3. PERCENTAGE HETEROSIS IN SELECTED TRAIT REALIZED IN THE CROSSBRED

Traits	Breed group		
	Landrace × Yorkshire	Duroc × Pietrain	Crossbred sows × Terminal sires
Litter size at birth			
Born alive	0.91	5.91	11.01
Born dead	11.54	−23.68	−6.25
Total pigs born	1.22	4.85	10.39
Litter size at weaning	3.34	16.67	20.74
Percent weaning based on pigs born alive	1.90	10.11	9.29
Weaning weight	1.23	7.74	7.58
Pigs weaned per sow per year	4.82	16.21	22.86

TABLE 4. THE EFFECTS OF YEAR ON THE DIFFERENT TRAITS

	Year[1]		
	1986	1987	1988
Litter size at birth			
Born alive	8.38	8.40	8.29
Born dead	0.28[a]	0.29[a]	0.36[b]
Total born	8.65	8.69	8.65
Percent stillborn (%)	3.32	3.39	4.25
Litter size at weaning	7.37	7.14	7.44
Percent weaning based on			
Total born	84.87[a]	81.90[b]	85.39[a]
Pigs born alive	87.83[a]	84.66[b]	89.13[a]
Weaning age (days)	30.50	29.92	32.39
Weaning weight (kg)[2]	6.32[c]	6.71[b]	7.19[a]
Gestation period (days)	114.42	114.76	114.93
Interval between weaning and conception (days)	17.84	18.46	17.73
Interval between two farrowing (days)	164.15	162.77	162.29
Farrowing rate (%)	76.02	74.53	72.79
Farrowing index	2.23	2.25	2.26
Pigs weaned per sow per year	16.40	16.13	16.77
First litter farrowed (%)	29.69	31.52	32.81

[1] Means followed by the same letter are not significantly different at $p < 0.05$.
[2] Adjusted to 30 days old at weaning.

TABLE 5. THE EFFECTS OF MONTH OF BIRTH OF THE LITTER ON THE DIFFERENT TRAITS

	Month[1]											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Litter size at birth												
Born alive	9.05[a]	8.92[abc]	8.73[abc]	8.63[cd]	8.83[abc]	8.31[de]	7.78[ef]	7.09[g]	7.38[e]	8.05[c]	8.04[c]	8.55[cd]
Born dead	0.23[ef]	0.24[ef]	0.22[ef]	0.14[g]	0.22[ef]	0.21[fg]	0.32[def]	0.43[b]	0.66[a]	0.39[bc]	0.36[bcd]	0.28[def]
Total born	9.25[a]	9.16[ab]	8.95[bc]	8.77[cde]	9.03[abc]	8.52[def]	8.11[g]	8.42[fg]	8.05[g]	8.44[ef]	8.40[fg]	8.83[bcd]
Percent stillborn (%)	2.65[def]	2.68[def]	2.14[ef]	1.63[f]	2.46[ef]	2.58[ef]	4.02[bcd]	5.12[b]	8.09[a]	4.83[b]	4.20[bc]	3.16[cde]
Litter size at weaning	8.02[ab]	8.11[a]	7.78[abc]	7.81[ab]	7.47[bc]	7.19[cd]	6.82[de]	6.58[ef]	6.08[f]	7.15[cd]	7.16[cd]	7.64[b]
Percent weaning based on												
Total born	86.22[abc]	88.22[a]	87.72[ab]	87.66[ab]	82.54[f]	84.01[cd]	83.63[de]	77.60[g]	75.41[h]	84.61[bcd]	84.91[bcd]	86.09[abc]
Pigs born alive	88.67[ab]	90.63[a]	89.83[ab]	89.13[ab]	84.58[cd]	86.68[bc]	87.09[bc]	82.01[d]	81.70[d]	88.70[ab]	88.68[ab]	88.75[ab]
Weaning age (days)	30.07	29.97	29.78	30.07	29.47	28.97	30.95	31.73	30.56	30.27	29.46	29.81
Weaning weight (kg)[2]	6.92[abc]	6.96[ab]	6.75[cde]	6.46[fg]	6.65[def]	6.54[efg]	6.63[def]	5.32[h]	6.83[bcd]	6.83[bcd]	6.93[abc]	7.01[a]
Gestation period (days)	114.45	114.52	114.56	115.11	114.92	114.60	114.82	114.86	115.14	115.13	114.93	114.55
Interval between weaning and conception (days)	24.49[b]	29.18[a]	18.41[de]	12.50[f]	13.51[f]	12.12[f]	12.70[f]	14.84[ef]	18.01[de]	19.64[cd]	21.89[bc]	18.77[cde]
Interval between two farrowings (days)	172.53	174.51	163.44	157.62	159.51	155.25	157.65	159.91	164.15	164.18	165.82	162.26
Farrowing rate (%)	73.10[def]	80.70[ab]	87.47[a]	78.25[abc]	81.27[ab]	77.04[bcd]	75.40[cde]	72.53[def]	65.15[h]	70.38[fg]	66.39[gh]	70.51[efg]
Farrowing index	2.13	2.09	2.24	2.32	2.29	2.36	2.32	2.29	2.23	2.23	2.20	2.26
Pigs weaned per sow per year	10.06[b]	17.01[b]	12.72[ab]	18.02[a]	17.08[b]	16.95[b]	15.81[c]	15.05[c]	13.57[d]	15.90[c]	15.83[c]	17.19[ab]

[1] Means followed by the same letters are not significantly different at $p<.05$

[2] Adjusted to 30 days old at weaning

minal sires showed higher percentage improvement compared with the averages of the four parental breeds (table 3). The litter size at birth born alive was 11.01% bigger, litter size at weaning was 20.74% bigger and the pig weaned per sow per year was 22.86% more than the average of the four parental breeds. These findings follow the same trends as reported by Gaugler et al. (1984), Sokolov et al. (1988), Johnson (1981) and Jung and Park (1982). These are also the major reasons for recommending Landrace × Yorkshire crossbred sows mated to terminal sires for the production of market hogs.

The effects of year on the different traits are presented in table 4. The average litter size born dead, the survival rate of pigs from birth to weaning and the average weaning weights were the only traits significantly affected by year of birth. In 1988, the litters farrowed had higher stillborn pigs but with heavier weaning weight than those in the other two years. The survival rate of pigs from birth to weaning in 1987 was significantly lower than in 1988. No explanation can be offered for these differences.

The effects of month of birth of the litter on the different traits are presented in table 5. Most traits had been affected by month of birth. The litters farrowed by all breed-groups in the month of September were significantly the smallest in terms of size at birth and at weaning. Furthermore, the average number of stillborn pigs and the corresponding percentage were highest also in September. The average farrowing rate was also lowest for sows bred to farrow in September. The pigs farrowed in September had also the lowest survival rate. Consequently, the average number of pigs weaned per sow per year was likewise lowest in September.

On the other hand, the average litter size at birth and at weaning were highest for litters farrowed in January to March. Survival rates of pigs born alive from birth to weaning were highest in January to April and in November to December. The month of April yielded the highest average number of pigs weaned per sow per year.

The results of this study strongly indicate that there are really highly significant monthly variations in the reproductive performance of sows. Appropriate management programs should be instituted to improve litter size, conception rate and survival rate of pigs from birth to weaning during specific months of the year.

There were no significant breed-group × month, breed-group × year, and month × year interactions observed in all traits studied.

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