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EWE PRODUCTIVITY OF COMPOSITE GENOTYPE RESULTING FROM CROSSBRED AMONG LOCAL SUMATRA SHEEP AND ST. CROIX AND BARBADOS BLACBELLY HAIR SHEEP

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Abstract

Genetics improvements through crossbreeding are one method that relatively faster to increase sheep productivity. Increasing productivity through crossbreeding, usually by exploiting the effect of heterosis. The crossbreeding of Sumatera Sheep (STT) with the hair sheep of St. Croix (SC) and Barbados Blackbelly (BB) have been conducted at the Research Institute for Animal Production (RIAP), in order to create new composite breed with genotype composition of 50% STT, 25% SC and 25% BB. The study was conducted at the Cilebut Research Station, of RIAP. The ewe productivity compared in this study were Barbados Cross (BC) resulting from inter se mating between BC x BC; the first generation of composite breed (K-F1) resulting from mating between St. Croix Cross ram with BC ewes; the second generation composite breed (K-F2) resulting from mating between K-F1 ewes with K-F1 rams. Results of the study showed that ewe production indicated by litter weight at weaning were no significantly different (P>0.05) among genotypes (BC, K-F1, K-F2). Litter weight for BC, K-F1, and K-F2 were 16.22; 16.21; and 16.8 kg, respectively. Lambing interval there were no significantly different among genotype, and respectively for BC, K-F1, and K-F2 were 273, 279, and 272 days. Litter sizes at birth and at weaning for BC, K-F1, K-F2 were 1.47; 1.47 and 1.46, respectively, for litter size at birth and there were 1.32; 1.26; and 1.29, respectively, for litter size at weaning. Ewe Productivity Index (EPI) that calculated based on litter weight at weaning divided by lambing interval in year and then divided by ewe weight for BC, K-F1, and K-F2 were 0.72; 0.68; and 0.72, respectively. These showed that the performances of K-F1, K-F2 and BC were still comparable.

Key words: Sumatera, St. Croix, Barbados Blackbelly, Hair sheep, Composite genotype, Ewe productivity

Introduction

Genetics improvements through crossbreeding are one method that relatively faster to increase sheep productivity. Increasing productivity through crossbreeding, usually

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by exploiting the effect of heterosis. The crossbreeding of Local Sumatera Sheep (STT) with the hair sheep of St. Croix (SC) and Barbados Blackbelly (BB) have been conducted at the Research Institute for Animal Production (RIAP), in order to create new composite breed with genotype composition of 50% STT, 25% SC and 25% BB. The study were started in RIAP station in Sungai Putih North Sumatera since 1986, and continued at the Cilebut Research Station, of RIAP since 1998. Previous study have been reported that F1 crossbred of BB x STT and F1 crossbred SC x STT were faster as compared to STT and F1 crossbred Java fat-tail lambs (Gatenby *et al.*, 1997a). Also Gatenby *et al.* (1997b) reported that litter weight at weaning at 90 days by BB x STT ewes and F1 SC x STT ewes were greater than those of F1 Java fat-tail x STT ewes and pure STT ewes (Gatenby *et al.*, 1997b). The superiority of F1 ewes was maintained into F2 generation of ewes producing F3 lambs (Doloksaribu *et al.*, 2000).

The objective of study were to compared ewe productivity of new composite breed (50% STT, 25% SC and 25% BB) with BC as contemporary due to their superiority in the first and second generation (Doloksaribu *et al.*, 2000; Gatenby *et al.*, 1997b; Subandriyo *et al.*, 1998). Ewe productivity in this study was measured by litter weight, particularly litter weight at weaning. These traits combine and summarize in one trait several different aspects of ewe reproduction (fertility and litter size) and of offspring growth (ewe milking and mothering ability and lamb growth rate and survival). Thus this traits an important biological and economic measure of ewe productivity (Martin and Smith, 1980).

Materials and Methods

The study were conducted at the Cilebut Research Station, Research Institute for Animal Production located at the altitude of 171 m above sea level, rainfall 1000-1500 mm per year, and temperature of 23-32^{0}C. The ewe genotypes that used for the study were Barbados Cross (BC) with genotype composition of 50% Sumatera (STT) and 50% Barbados Blackbelly (BB) resulting from *inter se* mating between BC x BC; the first generation of composite breed (K-F1) with composition of 50% STT, 25% BB and 25% St. Croix (SC) resulting from mating between St. Croix Cross ram with BC ewes; the second generation composite breed (K-F2) resulting from mating between K-F1 ewes with K-F1 rams.

All animals were confined in a group of 10 ewes. Chopped Elephant grasses were given *ad libitum*. In addition there were given commercial concentrate ration, that contain 16% crude protein, and 68% TDN. Dry and pregnant ewes were given the concentrate ration of 300-350 g per head per day. Lactating ewes were given 400 g per head per day. All lambs were weaned at 90 days and given the concentrate ration of 200-250 g per head per day.

Data collected in this study were from 4 lambing season of May-June 1998; January 1999; October 1999; and August 2000. Ewe performances that observed were litter weight at birth, litter weight at weaning, litter size at birth, litter size at weaning, mating weight, lambing weight and lambing interval. Data were analysed using the General Linear Model (GLM) procedure (SAS, 1987).

The model for litter weight at birth, litter weight at weaning, lambing weight and lambing interval included ewe genotype, litter size, ewe ages at lambing, and lambing season. However, the model for litter size at birth, litter size at weaning and mating weight included ewe genotype, ewe age at lambing and lambing season.

Results and Discussion

Results

Ewe productivity is indicated by litter weight at birth and litter weight at weaning. Litter weights at birth and at weaning were not affected by ewe genotypes (Table 1). This means that ewe productivity of BC, K-F1 and K-F2 was similar.

Meanwhile, other factors affecting significantly on litter weight at birth and at weaning were litter size at birth ($P<0.001$) and lambing season ($P<0.001$). These indicated that ewe with twins and multiple lambs had heavier litter weight at birth and at weaning as compared with ewe with single lambs. Litter weights at birth and at weaning tend to increase from one lambing season to the other. These show a response from selection that conducting every lambing season.

Litter size at birth and weaning were not affected by ewe genotype and lambing season (Table 2). Litter size of BC and K were relatively similar, which was around 1.5, with litter size at weaning of 1.3. These indicated that pre-weaning mortality was around 13.3%.

Ewe weight at mating (Table 3) were not significantly different among genotypes ($P>0.05$), however, K-F1 (26.96 kg) and K-F2 (26.11 kg) were heavier than that of BC (25.88). Similar results were showed by ewe weight at lambing, in which ewe genotype was not significantly on ewe weight at lambing (Table 3). The first generation of composite genotype (K-F1) and the second generation (K-F2) tended to have lambing weight heavier than that of BC.

Lambing interval of K-F1, K-F2, and BC were 279.74 days, 272.49 days, and 273.25 days, respectively (Table 3). The lambing interval was not affected significantly ($P>0.05$) by genotypes, litter size, and ewe age at lambing, but there was significantly affected by lambing season ($P<0.001$).

Table 1. Least squares means and standard error litter weight at birth, and litter weight at weaning of Barbados Blackbelly Cross (BC) and Composite genotype (K) according to ewe genotype, litter size, ewe age at lambing, and lambing season

Variables	N	Litter weight at birth (kg)	N	Litter weight at weaning (kg)
Ewe genotype		NS		NS
BC	85	4.18±0.09	85	16.22±0.76
K-F1	139	4.26±0.09	139	16.21±0.73
K-F2	31	4.44±0.16	31	16.08±1.33
Litter size		***		***
1	135	3.04±0.07a	135	11.06±0.60a
2	100	4.45±0.08b	100	15.68±0.73b
≥3	20	5.39±0.16c	20	21.77±1.36c
Ewe age at lambing		***		NS
< 18 mo	14	3.69±0.20a	14	13.88±1.70
18-30 mo	54	4.04±0.12a	54	16.39±0.99
30-42 mo	38	4.43±0.13b	38	16.90±1.10
42-54 mo	71	4.55±0.11b	71	17.04±0.93
> 54 mo	78	4.75±0.11c	78	16.63±0.94
Lambing season		NS		***
May 1998	36	4.26±0.14	36	12.73±1.18a
Jan 1999	59	4.20±0.11	59	14.46±0.96a
Oct 1999	70	4.25±0.10	70	17.87±0.86b
Aug 2000	90	4.47±0.10	90	19.62±0.81b

NS = non significant (P>0.05); *** = (P<0.001). Within each comparison, least squares means and standard error followed by the same letter is not different (P>0.05).

Discussion

The means of litter size at birth of BC, K-F1 and K-F2 were 1,48, 1,47 and 1,46, respectively, or around 1.5, with the average of number of lambs weaned of BC, K-F1 and K-F2 were 1.32, 1.26 and 1.29, respectively (Table 2). This indicated that pre-weaning mortality of BC, K-F1 and K-F2 was around 11%, 14% and 12%, respectively. Therefore, if the average of lambing interval of BC, K-F1, and K-F2 were 273, 280 and 273 days (Table 3) or 0.75, 0.77 and 0.75 years, respectively, thus, ewe reproduction rate calculated according to Gatenby (1986) for BC, K-F1, and K-F2 were 1.32/0.75 = 1.76; 1.26/0.77 = 1.64 and 1.29/0.75 = 1.72, respectively. These indicated that reproduction rate of BC was relatively better than those either of K-F1 or K-F2.

The average of litter weight at weaning of BC, K-F1, and K-F2 were 16.22 kg, 16.21 kg and 16.08 kg, respectively (Table 1), and the lambing interval were 0.75; 0.77 and 0.75 years, respectively, therefore flock productivity (FP) for BC, K-F1, and K-F2, according to Gatenby (1986) were 16.22/0.75 = 21.62 kg/year; 16.21/0.77 = 21.05 kg/year; and 16.08/0.75 = 21.44 kg/year, respectively.

Table 2. Least squares means and standard error of litter size at birth and weaning of Barbados Blackbelly Cross (BC) and Composite genotype (K) according to ewe genotypes, ewe age at lambing and lambing season

Variables	N	Litter size	N	Litter size at weaning
Ewe genotypes		NS		NS
BC	85	1.48±0.08	85	1.32±0.07
K-F1	139	1.47±0.08	139	1.26±0.07
K-F2	31	1.46±0.16	31	1.29±0.15
Ewe age at lambing		**		*
< 18 mo	14	1.22±0.20a	14	0.97±0.19a
18-30 mo	54	1.24±0.11a	54	1.15±0.10a
30-42 mo	38	1.45±0.13a	38	1.33±0.12ab
42-54 mo	71	1.63±0.11bc	71	1.46±0.10b
> 54 mo	78	1.79±0.11c	78	1.54±0.11b
Lambing season		NS		NS
May 1998	36	1.38±0.14	36	1.26±0.13
Jan 1999	59	1.47±0.11	59	1.18±0.10
Oct 1999	70	1.45±0.09	70	1.30±0.09
Aug 2000	90	1.57±0.09	90	1.42±0.09

NS - non significant (P>0.05); * (P<0.05); *** (P<0.01). Within each comparison, least squares means and standard error followed by the same letter is not different (P>0.05)

The dam productivity indexes or ewe productivity indexes (EPI) according to ILCA (Gatenby, 1986) were FP divided by weight of ewe. The EPI for those three genotypes were 21.62/29.87 = 0.72 for BC; 21.05/ 31.16 = 0.68 for K-F1; and 21.44/29.78 = 0.72 for K-F2, respectively.

Meanwhile, flock efficiency index (FEI) according to Fitzhugh and Bradford (1983) that calculated as FP divided by ewe weight power 0.75, for those three genotypes were $21.62/29.87^{0.75}$ = 1.69 for BC; $21.05/31.16^{0.75}$ = 1.60 for K-F1; and $21.44/29.78^{0.75}$ = 1.68 for K-F2, respectively.

FPI for BC, K-F1, K-F2 if there were compared with the study results reported by Gatenby *et al.* (1997b) on the STT sheep (16.0 kg) and the F1 of several crossbred of Java fat-tail x STT sheep (18.1 kg), SC x STT sheep (21.5 kg) and BB x STT sheep (24.2 kg) were relatively better than those of STT sheep and F1 crossbred Java fat-tail x STT sheep, but relatively similar to F1 crossbred SC x STT sheep. However, if there were compared to F1 crossbred BB x STT sheep, those three genotypes was relatively lowers. Meanwhile, results of the study were lower than those of total weaning weight divided by ewe weight as reported by Gatenby *et al.* (1997b). Gatenby *et al.* (1997b) reported that total weaning weight per unit of ewe body weight for STT, F1 crossbred of Java fat-tail x STT sheep, F1 crossbred SC x STT sheep, and F1 crossbred BB x STT sheep were 0.73; 0.74; 0.79 and 0.86, respectively.

Table 3. Least squares means and standard error of mating weight, lambing weight and lambing interval of Barbados Blackbelly Cross (BC) and Composite genotype (K) according to ewe genotype, litter size, ewe age at lambing, and lambing season

Variables	N	Mating weight (kg)	N	Lambing weight (kg)	N	Lambing Interval (days)
Ewe genotype		NS		NS		NS
BC	72	25.88±0.70	85	29.87±0.55	51	273.25±10.95
K-F1	119	26.96±0.67	139	31.16±0.53	92	279.74±9.05
K-F2	31	26.11±1.10	31	29.78±0.97	5	272.49±28.53
Litter size		-		NS		NS
1	-	-	135	31.03±0.44	63	269.13±11.67
2	-	-	100	29.99±0.53	70	283.10±11.80
≥3	-	-	20	29.79±0.99	15	273.25±18.76
Ewe age at Lambing		***		*		NS
< 18 mo	14	21.23±1.28a	14	25.06±1.24a	-	-
18-30 mo	45	23.93±0.81a	54	29.06±0.72b	14	269.07±18.11
30-42 mo	25	27.20±1.05b	38	32.14±0.81c	15	283.84±19.23
42-54 mo	60	28.64±0.88b	71	32.25±0.68c	45	284.71±14.43
> 54 mo	78	30.58±0.84c	78	32.84±0.69c	74	263.±12.41
Lambing Season		NS		*		***
May 1998	4	23.32±2.11	36	28.42±0.86a	-	-
Jan 1999	58	27.99±0.65	59	29.16±0.70a	33	217.88±14.82a
Oct 1999	70	26.82±0.55	70	32.05±0.63b	53	305.21±13.57b
Aug 2000	90	27.14±0.57	90	31.45±0.59b	62	302.40±12.24b

NS = non significant (P>0.05); * (P<0.05); ***(P<0.001). Within each comparison, least squares means and standard error followed by the same letter is not different (P>0.05)

Conclusion

The superiority of ewe productivity of the first generation of composite genotype (K-F1) was maintained into the second generation (K-F2), as indicated that there was not significantly different with the Barbados Cross (BC) as contemporary. Crossing of local sheep with two hair sheep breed for creating new sheep breed could be applied for increasing productivity of the native breed.

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