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THE IMPACT OF IMPROVED BREEDS ON GOAT PRODUCTION IN JAMAICA

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ABSTRACT

There is evidence that goats were imported into Jamaica as early as 1894 either from the Canary Island or Africa. There was however, no organized importation until the mid eighteenth century when the Nanny and Rupi goats were imported from Europe and Spain. Thereafter the Angora, Anglo-Nubian, Toggenburg, Saanen, Alpine, LaMancha and Boer have been introduced. The Caribbean Agricultural Research and Development Institute (CARDI) under the European Development Fund (EDF) Technology Transfer and Applied Research Project (TTARP) embarked on a goat development project in 1990. The activities included the introduction of improved genetic material, improved feeding, improved management and husbandry practices. Under the CARDI/EDF TTARP, eight Purebred Anglo-Nubian bucks and 36 does were imported from the UK into Jamaica in 1992. The first organized importation of Boer goats was in December 1996 when 17 and 4 Boer bucks and does respectively were imported from the USA. The present purebred Anglo-Nubian population in Jamaica is approximately 178 (75 bucks and 103 does), while that of purebred Boers is about 159, comprising 95 bucks and 64 does. To date over 10,000 native or graded does have been bred to the improved breeds, producing more than 16,000 crossbred Anglo-Nubian and Boer goats. Reproductive and growth performance of the Anglo-Nubian have been monitored over the past five years while data collection on the same parameters for the Boers commenced a year ago. The influence of the two breeds on the Jamaica goat industry is discussed within the context of socio-economic impact and effect on farm family income.

INTRODUCTION

The goat (*Capra hircus*) is one of the smallest domesticated ruminants which has served mankind earlier and longer than sheep and cattle (Haenlein, 1992). Although they are often kept as supplement animals by small holders, there are more than 460 million goats worldwide, producing more than 6 million tons of milk, meat, cheese, hair and leather. The goat population in Jamaica is estimated to be 450,000 owned by approximately 35,000 farmers (FAO, 1994). Because of their wide adaptability, goats are able to survive under diverse weather conditions and on marginal lands with low quality forages.

The importation of goats to Jamaica is not a new phenomenon as there were indication of importation as early as 1494 when the goat was brought in from the Canary Islands, Africa or Spain (Fielding and Reid, 1994). In the mid eighteenth century, goats referred to as the Nanny goat, the Rupi goat and the Bastard Ibex were imported from Europe and Spain. The first mention of a modern breed was the Angora in 1897 (JAS, 1897) while the presence of the Anglo-Nubian was documented in as early as 1907 followed by the Toggenburg in 1910. The Saanen was introduced from the USA in 1929 but it was not until 1945 the Alpine was introduced. The LaMancha, which never flourish as a breed in Jamaica, was introduced from the United States in 1980. Since the early 1970's there has been limited importation from England, the United States and Canada of mainly Nubian, Alpine, Saanen and Toggenburg.

A survey of the industry in 1991 (Robertson, 1992) indicated that there were several weaknesses in the industry the most glaring ones being; no organized rearing system, small size of the animals, no recording, low producing goats and absence of improved husbandry practices. This was in line with Gatenby, (1982) who stated that the major factors limiting productivity in most countries are poor nutrition and diseases coupled with inappropriate

genetic resources.

In 1992 CARDI using its multi mode dynamic technology generation and transfer to provide goat production technology (Asiedu and Fearon, 1996) imported forty-four purebred Anglo-Nubian goats (8 males and 36 females) from England under the Small Ruminant Sub-Project of the EDF Technology Transfer and Applied Research Project (TTARP). The interest stimulated by the early performance of this breed (Fearon and Asiedu 1996) paved the way for the first organized importation of the Boer towards the end of 1996.

Description of the Nubian: Although there are several instances where Nubians were brought into Jamaica, the earliest of the present breeds of goats were Anglo-Nubians brought in as early as 1907. The Anglo-Nubian was developed in England by crossing British goats with bucks of African and Indian origin. This all-purpose goat is useful for meat, milk and skin production. The Anglo-Nubian breeding season is much longer than that of the Swiss breeds so it is possible to produce milk year round. The Anglo-Nubian is regarded as an "aristocratic" appearing goat and has very long pendulous ears that hang close to the head. They carry a decidedly Roman nose and are always shorthaired. Any solid or parti-coloured coat is permitted in the Anglo-Nubian, but black, red and tan are the most common colours, any of which may be carried on combination with white. A mature doe should stand at least 75 cm at the withers and weigh 60 kg or over, while the males should stand at least 85 cm at the withers and weigh at least 80 kg.

Description of the Boer: This breed is regarded as the key to upgrading rural goats for meat production compared to other goats they are superior meat producers. This is the latest improved breed of goat imported into Jamaica. The Boer is an improved indigenous South African breed with some infusion of European, Angora and Indian goat breeding many years ago.

The name is derived from the Dutch word "Boer" meaning farm and was probably used to distinguish the native goats from the Angora goats which were imported into South Africa during the 19th century. The present day Boer goat appeared in the early 1900's when ranchers in the Eastern Cape Province started selecting for a meat type goat. The Boer goat is primarily a meat goat with several adaptations to the region in which it was developed. The dominant colour is white with red head. It is horned breed with lop ears and showing a variety of colour patterns. Producing weaning rates in excess of 160% the Boer doe is a low maintenance animal that has sufficient milk to rear a kid that is early maturing. The mature Boer buck weighs between 110-135 kg and ewes between 90 and 100 kg. Performance records for this breed indicate exceptional individuals are capable of average daily gains over 200 g/day in feedlot. More standard performance would be 150-170 g/day. The ovulation rate for Boer goats ranges from 1 to 4 eggs/doe with an average of 1.7. A kidding rate of 200% is common for this breed. Puberty is reached early, usually about 6 months for the males and 10-12 months for the females. The Boer goat also has an extended breeding season making possible 3 kidding every 2 years.

While reproductive and growth performances of the goat are the major tools for measuring the impact, the bottom line for any business is the cost of production and subsequently the profit margin. The socioeconomic implications can also be a determining factor for the success or failure of an enterprise. While there are few studies on performance of imported goats in Jamaica their overall impact on the industry is not documented. This paper, therefore, seeks to measure the impact of the Anglo-Nubian and the Boer goat on goat production in Jamaica. The socioeconomic impact and the way forward will also be discussed.

MATERIALS AND METHODS

Location: The study was conducted in the central parishes of St. Catherine, Clarendon, Manchester and St. Elizabeth in Jamaica. Participants included 25 goat farmers and the Bodles and Hounslow Research Stations of the Ministry of Agriculture.

Animals: The goats used in this study were reared under 5 different production systems. The breeds used were Native (less than 50% improved breed), Graded Nubian (at least 50% improved), Purebred Nubian or Boer

goats. The does were mated to Purebred Anglo-Nubian, Purebred Boer or Graded Nubian (more than 75% Nubian) bucks.

Management of Animals: All animals were managed according to prescribed production practices which included improved forages, improved housing, preventative health management, dehorning and hoof trimming. All animals were subjected to supplemental feed, mainly agro and industrial by-product rations.

Data Collection: Each participant was monitored constantly and records were checked to measure parameters. Informal surveys and personal communications were used to collect marketing and socioeconomic information from farmers, meat shops, supermarkets and other producers. Pre-intervention data collection on the Native commenced in 1992, while information on the Nubian and Boer were captured from 1993 and 1997, respectively. To measure the impact of both breeds, the distribution of all purebred animals was tracked.

Statistical Analysis: The data were subjected to an analysis of variance for a Completely Randomized Design (CRD) using the Genstat Software Package. The major effects included in the analysis were, year and breed or type of animals. Reproductive variables were measured by, litter size, kid mortality, productivity index (PI), birth and weaning weights; while growth performances of the offspring were measured from pre-weaning, and post weaning average daily gains (ADG).

PI = litter size x survival to weaning x weaning weight.

Weaning weight is adjusted to 90 days and disposal weight to 240 days. (Animals would either be sold for meat or incorporated into the breeding herd at 240 days).

Pre-weaning ADG is calculated from birth to 90 days. Post-weaning ADG from 91 – 240 days.

RESULTS AND DISCUSSION

Distribution: The ability of goats to adapt to various eco-zones and production systems is an economically important bearing on producing ability, demand for breeding stock and return on investment, (Casey and Van Niekerk, 1988). It is therefore important to track the distribution of all improved breeds introduced for genetic resources. The purebred Anglo-Nubian population up to March 1998 was approximately 178 (75 bucks and 103 does) (Figure 1). The animals were distributed throughout Jamaica with St. Elizabeth, St. Catherine and Clarendon having the bulk of the purebred Nubian. This is mainly due to the Bodles Research Station in St. Catherine, Hounslow Sheep and Goat Station in St. Elizabeth and small enterprise breeders in Clarendon. The imported Boer distribution, shown in Figure 2, indicated that the majority of these animals are found in St. Thomas, St. Catherine and Clarendon; with the headquarters of the Jamaica Boer Goat Association located in St. Thomas. Based on the doe population of 10,000 on farms where imported bucks have been distributed, and an average litter size of 1.65 kids per doe, it was estimated that there are over 16,000 crossbred Anglo-Nubian and Boer goats in Jamaica.

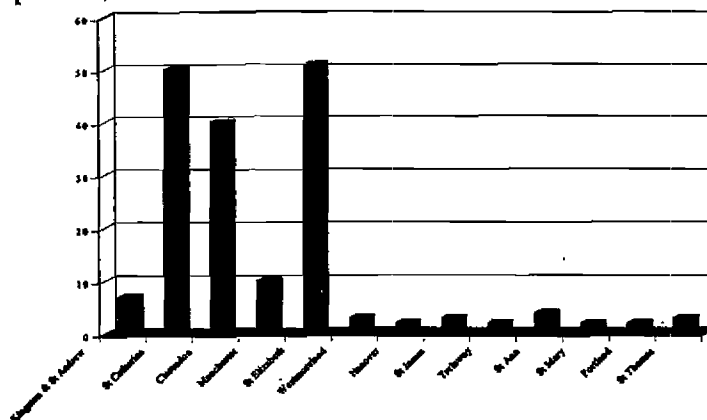


Figure 1: Distribution of purebred Anglo-Nubian in Jamaica

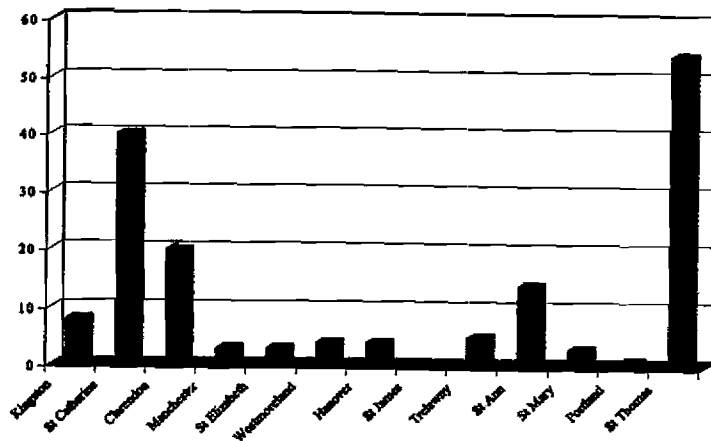


Figure 2: Distribution of purebred Boer goats in Jamaica

Reproductive performance: Kidding rate or prolificacy, defined as the number of kids born per doe kidding is an important contributing factor to reproductive efficiency, (McGowan and Nurse, 1992). High rates of reproduction and low pre-weaning mortality are very important requirements for goats because of their high litter size when compared to other domestic animals (Devandra & Burns, 1983; Shelton, 1978). According to Das, 1992, the productivity index derived from litter size and kid survivability can be used as a selection tool in developing the goat industry. Litter size, pre-weaning mortality and productivity index of the goats are shown in Table 1. The data indicated that the Boer and Anglo-Nubian litter sizes of 1.99 and 1.79 respectively, were above the national averages of 1.6 (Muschette et. al, 1989). The litter size of 1.99 for the Boer was significantly higher ($P<0.001$) than all the breeds or types of goats the lowest being the native with 1.43. There was an increase in the litter size of all breed combinations over the Native breed. The kidding rate of the Anglo-Nubian and Boer are comparable with those in studies conducted in Mexico and the United States (Montaldo et. al, 1995; Gipson, 1996). The high ($P<0.001$) pre-weaning mortality (17.16) exhibited by the purebred Anglo-Nubians seems to suggest the long period of adaptation and could be partly attributed to the fact that the imported animals were kidding for the first time. While there were wide ($P<0.001$) variations in the productive index of the breeds studied from a high of 23.85 kg for the Boer to a low of 14.08 kg for the Native goats all the cross showed increases in productivity index. The data presented in Table 2 shows an improvement in litter size and productivity index from 1992 to 1997, highlighting the contribution of the improved breeds. On the other hand, there was a steady decrease in kid mortality.

Table 1. Litter size, pre-weaning mortality and productivity index of major goat breeds/types in Jamaica.

Breed/Type Index (kg)	Litter Size	Mortality (%)	Productivity
Purebred Nubian	1.79	17.16	22.22
Graded Nubian	1.69	13.81	19.06
Native Goats	1.43	11.40	14.08
Purebred Boer	1.99	13.66	23.85
Boer x Graded Nubian	1.88	10.79	23.64
Nubian x Local	1.59	11.38	21.61
Boer x Local	1.68	13.81	21.52
Nubian x Boer	1.82	11.30	23.20
Degree of freedom	1208	582	582
S.e.d. ¹	0.80	2.76	1.59

¹S.e.d. Standard error of difference between means

Table 2. Litter size, pre-weaning mortality and productivity index of major goat breeds/types in Jamaica from 1992 - 1998.

Year	Litter Size	Mortality (%)	Productivity Index (Kg)
1992	1.52	18.68	14.83
1993	1.68	17.41	17.24
1994	1.65	13.13	18.74
1995	1.72	11.89	19.36
1996	1.64	12.95	18.95
1997	1.82	12.05	22.32
1998 ¹	1.73	11.37	22.62
Degrees of freedom	1208	582	439
S.e.d. ²	0.50	1.62	0.92

¹ Data collected to march 1998² S.e.d. Standard error of difference between means

Growth Performance: Growth expressed as average daily gain (ADG) can be effectively divided into two periods, growth before weaning and growth after weaning. A high pre-weaning ADG reflects both the genetic potential of the kid and the mothering ability of the doe. Where kids are not sold as weaners, the post-weaning ADG becomes an important production factor. The average birth, weaning and 8-month weights are presented in **Table 3**. Variations exist among the breeds and crosses for all 3 parameters, from the fast growing Boer to the slow growing Native goats. The pattern, however, is the same for birth, weaning and 8-month weights with the Boer highest ($P < 0.001$) at 3.34, 18.37 and 37.61 kg and the Native the lowest at 2.20, 11.54 and 23.17 kg for birth, weaning and 8-months weights respectively.

Table 3. Birth, weaning and 8-month weights of major goat breeds/types in Jamaica.

Breed/Type	Birth Weight (kg)	Weaning Weight (kg)	8-Month Weight(kg)
Purebred Nubian	3.26	16.85	32.95
Graded Nubian	2.79	14.58	28.81
Native Goats	2.20	11.54	23.17
Purebred Boer	3.34	18.41	37.61
Boer x Graded Nubian	3.24	18.37	37.03
Nubian x Local	2.43	12.47	25.47
Boer x Local	2.81	13.21	30.12
Nubian x Boer	3.47	20.71	30.37
Degrees of Freedom	1203	1058	596
S.e.d. ¹	0.18	1.04	1.57

¹ S.e.d. Standard error of difference between means

The data in **Table 4** shows an increase in growth parameters from 2.35, 11.08 and 21.21kg in 1992 to 3.09, 17.07 and 33.88kg in 1988 for birth weight, weaning, and 8-month weights respectively. The pre-weaning ADG of the Boers (191gm/day) shown in **Table 5** are consistent with those in the United States (Gipson, 1996), while the Nubians were higher (151gm/day vs. 115gm/day). The Native goats again recorded the lowest pre and post-weaning ADG. The data in **Table 6** demonstrates a steady increase in pre-weaning and post-weaning ADG from 96.78 and 75.72gm/day to 155.62 and to 120.50gm/day from 1992 to 1998 respectively. This is an indication that as the influence of the Anglo-Nubian and Boer becomes entrenched, the growth performance increased gradually.

The Market: While the status of goat production is on the improve (Fearon and Asiedu, 1996) the marketing is rather haphazard with substantive variations in the availability of animals, slaughter facilities, carcass characteristics and standard processing techniques. According to Pinkerton et. al., (1993), rationalization of production and marketing of slaughter goats seem essential if future demands is to be met without destructive price rises and equitable returns. The changes in prices presented in Table 7 indicated that there was a 264% increase in the price of meat from US\$1.25 and 3.15 to US\$3.30 and 8.33 for live weight and dress weight respectively, from 1992 to 1998. The change in the costs of breeding stock is even more dramatic with over 500 % increase in prices. This high increase, however, may be attributed to the introduction of the Boer genetics, which are imported at high costs.

Farm Family Income: If goat production is to flourish as an industry, it must be sustainable and profitable. The assets, expenditures, income and profit margin are presented in Figure 3. The information is indicating that the farmers have increased their asset base substantially mainly, due to the improved breeds of animals they possess. While farmers are spending more over the years on production, their profit margin at worst remain constant.

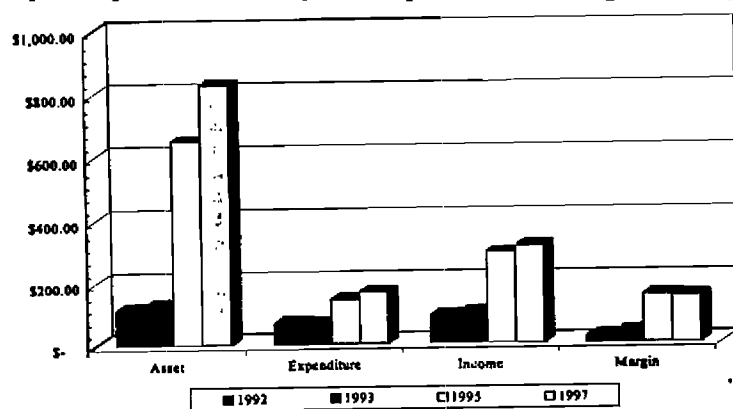


Figure 3: Asset, expenditure, income and profit margin of selected goat farmers in Jamaica.

Socioeconomic Impact: The income generating potential of the improved breeds will contribute to an improvement in the farm family income since large-scale goat production can now be a reality. Where goat production was practiced as a hobby the operations are now trending towards businesses. The nature of the animals enables the entire family to participate in the production and management aspects. The successful goat industry will always have spin-off effect on the community at large as seen in the fact that four feed companies in Jamaica are now for the first time producing formulated supplements for goats. In an effort to structure the industry the Goat Breeders Society of Jamaica (GBSJ) was established in 1997 with over 200 members. One way to validate production is to display ones work to the public and this was evident in livestock shows where the improved goats and their crosses dominate the exhibits. All the above activities are conducive to the creation of jobs.

Table 4. Birth, weaning and 8-month weights of major goat breeds/types in Jamaica from 1992-1998.

Year	Birth Weight (kg)	Weaning Weight (kg)	8-MonthWeight (kg)
1992	2.35	11.08	21.21
1993	2.57	12.49	25.26
1994	2.64	12.79	26.64
1995	2.80	12.99	26.80
1996	2.89	13.17	28.17
1997	2.93	16.93	31.67
1998 ¹	3.09	17.07	33.88
Degrees of freedom	1204	579	579
S.e.d. ²	0.08	0.42	0.66

¹ Data collected to march 1998

² S.e.d. Standard error of difference between means

Table 5. Pre-weaning and post-weaning average daily gains of major goat breeds/types in Jamaica.

Breed/Type	Pre-weaning ADG ¹ (gms/day)	Post-weaning ADG ² (gms/day)
Purebred Nubian	151.00	108.16
Graded Nubian	130.54	97.93
Native Goats	104.66	83.22
Purebred Boer	167.26	135.52
Boer x Graded Nubian	168.01	123.96
Nubian x Local	111.55	86.34
Boer x Local	115.57	111.73
Nubian x Boer	191.62	103.44
Degrees of freedom	1058	582
S.e.d. ³	11.02	9.35

¹Pre-weaned ADG, Birth to 90 days

²Post-weaning ADG, 91-240 days

³S.e.d. Standard error of difference between means

Table 6. Pre-weaning and post-weaning average daily gains of major goat breeds/types in Jamaica from 1992-1998.

Year	Pre-weaning ADG (gms/day)	Post-weaning ADG (gms/day)
1992	96.78	75.72
1993	110.09	87.04
1994	112.81	88.09
1995	113.15	91.74
1996	113.85	99.93
1997	155.04	101.06
1998 ¹	155.62	120.50
Degrees of freedom	1058	582
S.e.d. ²	4.40	3.91

¹Data collected to march 1998 ²S.e.d. Standard error of difference between means

Table 7. Changes in cost for meat and breeding stock from 1992-1998 Year.

Year	Average Price (US\$)			
	Meat (price/Kg)		Breeding Stock (price/head)	
	Live Weight	Dress Weight	Does	Bucks
1992	1.25	3.15	43.00	72
1993	1.55	3.80	58.00	86.63
1994	2.35	4.70	75.75	108.75
1995	2.92	5.42	93.75	148.50
1996	3.19	6.33	108.75	195.00
1997	3.30	8.25	130.00	216.5
1998	3.30	8.33	222.00	420
%Increase	264.00	264.00	516.00	580.00

CONCLUSION

The result from the study suggests that the improved breeds of goats have high productive capacity with opportunities to exploit their potential to improve the productivity of the Native goat. The increased activity on goat production and on marketing over the past five years is steering the enterprise into a self-sustaining one. The introduction of the Anglo-Nubian and more recently, the Boer has changed the economic outlook of the goat industry stimulating the participation of other agencies. While there are structured production practices, the market is undefined and haphazard.

RECOMMENDATION

The present system of marketing is haphazard, therefore, there is the need for the development of structured marketing system that will take into consideration the development of local standards for meat and breeding stock. The farm level record keeping system for individual animal is partially in place but there is the need for a national database in order to assess performance, enabling selection and retention of superior genetic resources. The high price of breeding stock is a major concern, so in order to expedite the breed improvement process the possibility of artificial insemination (AI) should be explored not only to lower cost but to capture the dominant traits of elite sires to improve or standardize production. In order to maximize profits more attention must be paid to the value added products of the industry. A few that comes to mind is the promotion of goat milk and cheese as a health therapy, leather craft for the craft market and the use of manure for vegetable production.

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