Research Note

AVERAGE GROWTH RATE OF HOLSTEIN HEIFERS RAISED IN PUERTO RICO[1]

The growth rate and adult size of Holsteins in the humid-tropical environment, when managed under the commercial systems followed by the dairymen in Puerto Rico, are smaller when compared with those of the subtropical and temperate zones[2]. Different hypotheses have been advanced to explain this smaller adult size of animals, that are predominantly the second or higher generation product of artificial insemination with imported semen from the United States whose donors have normal size and weight.

One such hypothesis in that the young animals are frequently restricted to an all or predominantly grass ration before their rumen is sufficiently developed to consume sufficient forages to meet their minimum requirements for maintenance and growth. Another postulates that the tropical heat-humidity stress somehow does not allow the animal's genetic potential for growth to express itself optimally. Still another is the frequent allegation that the low quality of tropical forages, when compared with the nutritive value of legumes, is responsible.

The purpose of this work is to integrate the available fragmentary knowledge into an integral overall view of the problem.

Soldevila and Salas[3] reported that the average birth and adult weights of Holstein animals in the AES Holstein herd at Gurabo were 80% of the standard. Holstein heifers reached and surpassed the standard for their age when enough energy, protein, vitamins, and minerals were supplied, even though at 6 months of age the animals were approximately at 80% of their growth potential[4].

Data from all purebred (370) and high grade (287) Holstein heifers from the Gurabo herd for the years 1960 to 1974 were pooled to establish the average birth weight and weight of dam at parturition. A sample of 24 animals predominantly from the latest years, whose weights were

[1] Manuscript submitted to the Editorial Board September 22, 1975.

[2] Cora-Morales, D., La evaluación del tamaño de animales Holstein a los 3, 6, 12 y 24 meses de edad en vaquerías de la Región Agrícola de Caguas, M. S. thesis, Mayagüez Campus, UPR, May 1972.

[3] Soldevila, M., and Salas, B., Birth weight and height at the withers of purebred and grade Holstein heifer calves of the Agricultural Experiment Station herd, J. Agric. Univ. P. R. 52(3): 177–8, 1968.

[4] Salas, B., Llinás, J., and Soldevila, M., Estudio comparativo de dos sistemas de alimentación para novillas lecheras de 6 a 24 meses de edad, Est. Exp. Agric., Univ. P. R., Bol. 223, julio 1970.

taken at precise monthly intervals, was used to establish the average weight representative of every 3-month interval. Data so obtained, described in table 1, were compared with the USDA standard[5], and to that indirectly recommended by the NRC[6].

The data from 14 years of observation are presented in table 1. They substantiate the partial data previously summarized and published by the author[3], and basically coincide with the commercial herd data reported by Cora[2] in 1972.

The average weight of 72 Holstein heifers recently used in the Isabela Substation experiment[7] and obtained from the Fonalledas dairy, a modern commercial dairy, was compared with the Gurabo data. The average weight at 9 months of age was 418 lb, almost equivalent to the weight of 425 lb included as representative for this age.

Pertinent and important practical inferences can be made from the available data. In figure 1, which describes the rate as percentage of the USDA standard, a dramatic percentage decrease as compared to the USDA standard becomes apparent from 6 to 12 months of age in the Gurabo herd. This decrease is not apparent from 9 to 12 months in the Isabela group, which were fed high quality forages. Based on such complementary information, it can be deduced that the average animal in Gurabo did not or could not consume enough of the available suboptimum quality forage to meet its nutritional demands for maintenance and adequate growth rate up to the time that its average weight surpassed 500 lb, which in this group coincided with an age of 12 months. This supposition is further substantiated by recent preliminary data from the Gurabo Substation[8], which indicates that at present, when all young heifers in the herd are fed abundant hay from high quality tropical forages from one month old on, they grow at a normal rate.

Figure 2 shows the representative curves of the USDA, the AES Gurabo herd, and the Isabela experiment. The AES-Gurabo and the Isabela animals did not attain an age weight comparable to that reported for the United States. Both the Gurabo and Isabela groups at 9 months of age were at approximately 76% of the USDA standard[5], and although they followed different growth trends, they reached a 24–25 month age weight equivalent to 83% of the same standard. Assuming first breeding at 700 lb liveweight, the average animal in both groups reached that point at approximately 16 months of age, resulting in a

[5] U.S. Dep. Agric., Farmers Bull. 2176, 1965.

[6] Nutrient Requirements of Dairy Cattle, Natl. Acad. Sci., Washington, D.C., 1971.

[7] Mendoza, R., Tres sistemas de alimentacion en la crianza de novillas para reemplazos. (In press).

[8] Personal communication from Mr. Herman Cestero, Former Associate Animal Husbandman in Charge, under whose supervision the work was conducted.

TABLE 1.—*Liveweight in kilograms (and pounds) of Holstein animals representative of the Gurabo-AES-UPR herd, the USDA herd, and the NRC excellence goal, at different age intervals*[1, 2, 3]

Item	Birth[4]	3 mo	6 mo	9 mo	12 mo	15 mo	18 mo	21 mo	24 mo	Calving[5]	Cows[6]
UPR herd	35 (78)	80 (177)	147 (323)	193 (425)	229 (503)	286 (630)	337 (742)	385 (846)	432 (951)	499 (1098)	540 (1189)
Actual growth rate		0.5 (1.1)	0.7 (1.6)	0.5 (1.1)	0.4 (0.9)	0.6 (1.4)	0.5 (1.2)	0.5 (1.2)	0.5 (1.1)		
NRC Std.	44 (96)	75 (165)	142 (313)	210 (462)	277 (610)	345 (759)	412 (907)	478 (1052)	535 (1178)		
NRC growth rate goal		0.3 (0.6)	0.8 (1.7)	0.8 (1.7)	0.8 (1.7)	0.8 (1.7)	0.8 (1.7)	0.8 (1.7)	0.7 (1.5)		
P.R. % of NRC goal	81	107	103	92	82	83	82	80	81		
USDA Std.	44 (96)	97 (213)	179 (394)	254 (559)	324 (713)	366 (805)	419 (921)	466 (1025)	516 (1135)	—	623 (1371)
P.R. % of USDA Std.	81	83	82	76	71	78	81	83	84	—	87

[1] Gurabo-AES-UPR herd data from 3 to 24 months of age is based on 24 observations from animals from all years evaluated, whose weights were consistently taken at precise monthly intervals. Since record keeping improved considerably at the Gurabo Substation from 1970 on, the observations are predominantly from 1970–4.

[2] USDA herd data as reported in Technical bulletin 1099, 1959.

[3] NRC excellence goal as indicated in technical publication ISENO-309-01916-8, Nutrient Requirements of Dairy Cattle, 1971.

[4] Birth weight data represent 658 observations from 1960 to 1974.

[5] Dam weight at calving data represent 654 observations from 1960 to 1974, that include from the first to the nth partuition of different animals, but many times the same animal.

[6] Based on 126 observations taken in August, 1975.

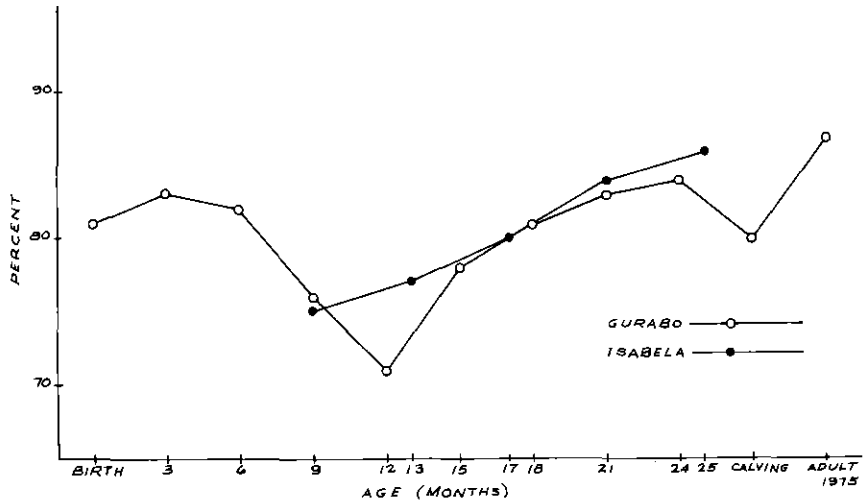

FIG. 1. – Historical Gurabo-AES-UPR herd data for birth through calving from 1960 to 1974; adult 1975 weights; and Isabela experiment results expressed as percentage of the USDA-Beltsville growth standard

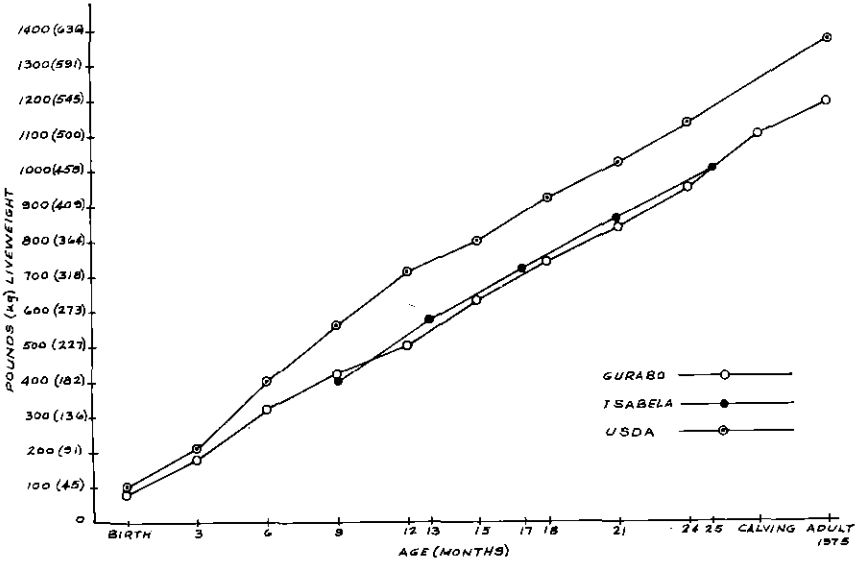

FIG. 2. – Historical Gurabo-AES-UPR herd weight data for birth through calving for 1960 to 1974, Isabela growth experiment curve, and USDA-Beltsville growth curve

projected first calving at 25 months of age, when weighing approximately 1000 pounds. The average animal does gain additional weight after the first parturition as shown by the fact that in this study the

average dam weight at parturition (654 observations representative of 1st to nth parturitions) was 1097 lb liveweight. This average closely approaches 1170, the optimum weight determined for dairy cows by Miller et al.[9], when production and conversion were used as criteria for evaluation. The present average weight of the 126 cows of the Gurabo AES-UPR herd is 1189 lb, approximately 90 lb heavier than the historical average of the herd, and almost identical to that reported as optimal by the ARS[9].

Results of studies carried out by Salas, Llinás and Soldevila[4], and Kali and Amir[10], indicate that in tropical and subtropical zones, adequately fed Holstein animals grow as rapidly as in the United States and other temperate zones. Kali and Amir further established that these animals have an earlier estrus, may be bred younger, and accordingly, may reach the first lactation earlier and have a higher lifetime production. On the contrary, one must realize that the resulting large animals may not be the most efficient converters[9]. It is in view of these trends and their projected implications, that an economically viable solution must be found to produce regular size (for age) dairy animals in the Puerto Rican commercial herds.

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[9] Miller, R. H., Hoover, N. W., and Smith, J. W., For better feed converters, Agricultural Research. 19:(7), p.10, January 1971.

[10] Kali, J., and Amir, S., Increasing dairy cattle production, Agricultural Research 23:(12) p.10, 1975.