Introduction and evaluation of Romosinuano in the U.S.A.

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Introduction

In the warm regions of the U.S.A., adapted breeds of cattle are primarily limited to *Bos indicus* (Zebu), mainly American Brahman, and to breeds developed by crossing with Brahman. Some characteristics of purebred Brahman cattle that have been criticized include reproductive and feedlot performance, carcass quality and meat tenderness, temperament, and calf survivability (Cartwright, 1980; Franke, 1980; Turner, 1980). Therefore, the major niche for Brahman cattle in the U.S.A. has been in crossbreeding systems that combine the heat tolerance of the Brahman with the desirable reproductive and carcass traits of temperate *Bos taurus* breeds. Additionally, pre- and postweaning performance, as well as maternal performance of *Bos indicus* x *Bos taurus* F1 crossbreds are exceptional and levels of heterosis are high (Cundiff, 1970; Franke, 1980; Koger, 1980). There are, however, other tropically adapted breeds of cattle in the world that have potential to improve efficiency of beef cattle production in warm regions of the U.S.A.

At the Subtropical Agricultural Research Station (STARS), Brooksville, Florida, our mission includes the evaluation of tropically adapted breeds of cattle under U.S.A. conditions in subtropical Florida. Our approach has been to focus on tropically adapted *Bos taurus* breeds and our evaluations have included Senepol, Tuli, and most recently, the Romosinuano. The Romosinuano is a tropically adapted, criollo beef breed native to Colombia. The breed derived its name from its origin in the Sinu river region (sinuano) of northern Colombia and its polled (romo) character (Rouse, 1977). Romosinuanos are purported to be highly fertile, and are noted for their longevity, docile temperament, and combining ability with *Bos indicus* (de Alba, 1987; Derr *et al.*, 1995; Martinez-Correal, 1995). The long term objectives in our evaluation of the Romosinuano are to investigate its growth, reproductive performance, and carcass quality. Short term objectives have been to determine the effect of breed of recipient dam and estrous synchronization treatment on pregnancy and preweaning performance of Romosinuano embryo transfer calves, to evaluate postweaning growth and reproductive development in bulls through 20 months of age, to evaluate postweaning growth, to measure heat toler-

ance, and to determine age and body weight at puberty in heifers raised in central Florida. These short term objectives have been conducted using Romosinuano germplasm obtained as embryos from Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), Turrialba, Costa Rica. Because we recognized that the genetic sample from Costa Rica was narrow and not pure Colombian Romosinuano, an additional objective has been to acquire pure Romosinuano germplasm of Colombian origin.

Effect of breed of recipient dam and method of estrous synchronization on pregnancy and performance of Romosinuano embryo transfer Calves

In 1990 we received 77 cryopreserved Romosinuano embryos from the University of Missouri that had been collected from Romosinuanos at CATIE, Turrialba, Costa Rica. This Costa Rican herd of Romosinuano was established in the 1950s using foundation Romosinuanos obtained from North Carolina State College, U.S.A. (de Alba, 1984). In 1990, the breed composition of this herd of approximately 150 cows at CATIE was estimated to be about 60% North Carolina Romosinuano, 20% Central American Milking Criollo, and 20% other breeds (Hammond *et al.*, 1996a). In 1992, we received an additional 38 cryopreserved Romosinuano embryos from the same source as in 1990. In 1990, 75 embryos were transferred, and in 1992, 40 embryos were transferred (2 from 1990, and 38 from 1992). In both years, Angus and Brahman recipients were used in order to determine the effect of breed of recipient dam on pregnancy and calving after transfer of Romosinuano embryos. Breed of recipient dam did not affect the percentage of recipients pregnant or calving in either year (Table 7.1). Thirty-six Romosinuano calves were born in 1991 from the 75 embryos transferred in 1990 (48% calving), and 18 Romosinuano calves were born in 1993 from the 40 embryos transferred in 1992 (45% calving).

Also in this study, our interests included the effect of estrous synchronization treatment on estrus, and the percentage of recipient dams pregnant and calving after embryo transfer (Chase *et al.*, 1992a). Each year a subset of recipients (about 30 of each breed) were synchronized using progestogen (Syncro-Mate-B) or prostaglandin (Lutalyse) treatments. The progestogen treatment included the administration of an ear implant (6 mg norgestomet) and injection (3 mg norgestomet and 5 mg estradiol valerate) on day 0, and removal of the implant on day 9. The prostaglandin treatment included injections of prostaglandin on days 0 (25 mg), 11 (12.5 mg) and 12 (12.5 mg). This sequence of prostaglandin administration previously had been shown to result in a higher percentage of pregnancies in artificially inseminated Red Brangus cows when compared to the standard double injection sequence (25 mg of prostaglandin on days 0 and 11; Santos *et al.*, 1988). The estrous synchronization treatments were applied to recipient dams that received Romosinuano

embryos in 1990 and 1992, and to recipient dams that received Brahman embryos in 1991. The overall estrus response, and percentage of recipient dams pregnant and calving did not differ (P > .10) between estrous synchronization treatments, and did not differ (P > .10) between breeds (table 7.2). We concluded from these data that acceptable pregnancy and calving rates occurred with both progestogen and prostaglandin treatments, and with both Brahman and Angus recipient dams.

Table 7.1. Effect of breed of recipient dam on pregnancy and calving after transfer of Romosinuano embryos.

		Breed of recipient dam	
Year	Item	Angus	Brahman
1990	Nº of recipients	36	39
	Nº. pregnant	22	20
	Pregnancy, %	61	51
	Nº calving	18	18
	Calving, %	50	46
1992	Nº of recipients	20	20
	Nº pregnant	10	9
	Pregnancy, %	50	45
	Nº calving	10	8
	Calving, %	50	40

Table 7.2. Main effects of estrous synchronization treatment and breed of recipient dam on estrus, and pregnancy and calving after embryo transfer.

		Treatment		Breed	
Item	Year	Progestogen	Prostaglandin	Angus	Brahman
Nº in estrus/					
	1991	28/30 (93)	26/30 (87)	29/30 (97)	25/30 (83)
	1992	22/27 (81)	17/28 (61)	20/28 (71)	19/27 (70)
	All	71/87 (82)	68/88 (77)	70/88 (80)	69/87 (79)
Nº pregnant/					
	1991	13/28 (46)	10/25 (40)	14/29 (48)	9/24 (38)
	1992	9/21 (43)	8/16 (50)	9/19 (47)	8/18 (44)
	All	34/70 (48)	36/65 (55)	37/69 (54)	33/66 (50)
Nº calving/					
	1991	9/28 (32)	8/25 (32)	9/29 (31)	8/24 (33)
	1992	8/21 (38)	8/16 (50)	9/19 (47)	7/18 (39)
	All	27/70 (38)	31/65 (48)	29/69 (42)	29/66 (44)

The effect of breed of recipient dam on preweaning performance of

Romosinuano calves born in 1991 and 1993 was also investigated (Chase *et al.*, 1992b; Chase *et al.*, 1994). In 1991, length of gestation was 5 days longer ($P < .05$) for Romosinuano calves from Brahman recipient dams than for Romosinuano calves from Angus recipient dams (table 7.3). Romosinuano calves from Brahman recipient dams were 3.6 kg heavier ($P < .05$) at birth and 66 kg heavier ($P < .05$) at weaning (adjusted to 205 days) than Romosinuano calves from Angus recipient dams. These data suggested that milk production and(or) milk composition may have affected weaning weights in 1991. Therefore, in 1993, we estimated 24-hour milk production and composition on days 28, 56, 84, 112, 140 and 169 after calving. However, unlike 1991, in 1993, there were no breed of recipient dam effects ($P > .10$) on length of gestation, birth weight, or weaning weight. Furthermore, Angus cows had 1.4 kg / day greater ($P < .05$) milk production than Brahman cows, but similar milk fat production because Brahman cows had higher ($P < .05$) percentage of milk fat. In summary, a total of 115 Romosinuano embryos from Costa Rica were transferred to Angus and Brahman recipient dams at STARS, 54 Romosinuano embryo transfer calves were born, and 53 Romosinuano calves were weaned.

Table 7.3. Effect of breed of recipient on dam performance and preweaning performance of Romosinuano embryo transfer calves.

		Breed of recipient dam	
Year	Item	Angus	Brahman
1991	No. of cows	18	18
	Length of gestation,* d	282 ± 1.2	287 ± 1.1
	Birth weight,* kg	28.8 ± 1.02	32.4 ± .92
	Adj. 205-d weaning wt.,* kg	156 ± 6.0	222 ± 5.2
	Adj. wt./454 kg of cow,* kg	167 ± 8.3	193 ± 7.3
1993	No. of cows	10	8
	Length of gestation, d	283 ± 1.3	284 ± 1.5
	Birth weight, kg	34.1 ± 1.03	31.6 ± 1.15
	Adj. 205-d weaning wt., kg	211 ± 3.4	204 ± 4.1
	Adj. wt./454 kg of cow, kg	202 ± 6.4	198 ± 7.7
	Milk production,* kg/day	8.2 ± .37	6.8 ± .41
	Milk fat,* %	3.7 ± .20	5.0 ± .23
	Milk fat, kg/day	0.30 ± .015	0.34 ± .017
	Milk protein, %	3.0 ± .06	3.1 ± .07
	Milk protein, kg/day	0.24 ± .010	0.21 ± .012

*$P < .05$.

Postweaning growth and reproductive development in bulls through 20 months of age

After weaning in fall of 1991, 13 Romosinuano, 25 Angus, 17 Brahman and 9 Nellore x Brahman bulls were managed as a single group on bahiagrass (*Paspalum notatum*) pasture and fed 4.5 kg of concentrate (85% corn, 5% molasses and 10% protein premix) with monensin (150 mg) for about 1 year (Chase *et al*., 1993; Chase *et al*., 1995; Chase *et al*., 1997). During periods of low forage availability, bahiagrass hay was offered free choice. At approximately 6-week intervals, bulls were weighed and scrotal circumference was measured. When bulls were about 12 months of age and every 84 days until about 20 months of age, bulls were libido tested on two consecutive days (Chenoweth *et al*., 1996a), and 1 week later a breeding soundness examination (Chenoweth *et al*., 1996b) was conducted using electroejaculation and included spermatozoa counts to asess pubertal status (Chase *et al*., 1997; where puberty is defined as 50 million sperm per ejaculate with at least 10% motility).

Breed x age influenced ($P < .001$) body weight (figure 7.1a) and scrotal circumference (figure 1b) from weaning through 20 months of age. These interactions were caused by different patterns of growth in body weight and scrotal circumference among breeds. Body weights of Romosinuano bulls were less than Brahman and greater than Angus from weaning until about 12 months of age. By 12 months of age, body weights were similar between Romosinuano and Brahman bulls and this trend continued through 20 months of age. Scrotal circumference of Romosinuano and Angus bulls were similar throughout most of the study, and both were larger than *Bos indicus* bulls with the largest differences observed from weaning through 17 months of age. These differences in scrotal circumference may be due to the fact that the *Bos taurus* bulls had reached puberty by 17 months of age. Libido scores of Angus bulls were consistently greater than *Bos indicus* bulls at all test periods (figure 2). Libido scores of Romosinuano bulls appeared to increase at each test period so that at the final test period libido scores of Romosinuano bulls were intermediate between Angus and *Bos indicus* bulls. Estimates of age, body weight, scrotal circumference, and other traits at puberty among breeds of bulls are presented in table 4. Five of 17 Brahman bulls did not reach puberty by the last semen collection date and their data were not included in the analysis. Brahman and Nellore x Brahman bulls (*Bos indicus*) were ($P < .05$) older, heavier, taller, had smaller scrotal circumferences and larger pelvic dimensions than Angus and Romosinuano bulls (*Bos taurus*) at puberty. Paired testicular volumes did not differ between *Bos indicus* and *Bos taurus* bulls at puberty. Brahman, Romosinuano and Nellore x Brahman bulls (tropical breeds) were ($P < .05$) heavier, taller, had smaller scrotal circumference and paired testicular volumes, and larger pelvic measures than Angus bulls (temperate breed) at puberty. Although the tropically adapted breeds did not differ in age at puberty from Angus bulls, Brahman bulls were ($P < .05$) older, heavier, taller and had larger pelvic heights than

Romosinuano bulls at puberty. However, Brahman and Romosinuano bulls did not differ in scrotal circumference, paired testicular volume, pelvic width or pelvic area at puberty.

Table 7.4. Traits at puberty in Angus, Brahman, Romosinuano and Nellore x Brahman bulls[a].

	Breed			
Traits at puberty	Angus	Brahman	Romosinuano	Nellore x Brahman
Age (d)[bd]	429.6 ± 18.7	509.7 ± 20.9	432.8 ± 20.1	468.3 ± 24.2
Body weight (kg)[bcd]	310.1 ± 18.5	402.5 ± 20.7	339.6 ± 19.8	343.3 ± 23.8
Hip height (cm)[bcd]	114.3 ± 1.6	133.8 ± 1.8	122.7 ± 1.7	134.8 ± 2.1
Scrotal circumference (cm)[bc]	30.4 ± .7	28.2 ± .8	28.8 ± .8	27.4 ± .9
Paired testicular volume (cm^3)[c]	516.8 ± 27.6	434.6 ± 30.8	429.1 ± 29.6	395.1 ± 35.6
Pelvic width (cm)[bc]	11.0 ± .2	12.3 ± .3	12.1 ± .3	12.2 ± .3
Pelvic height (cm)[bcd]	14.0 ± .2	16.4 ± .3	15.3 ± .2	16.6 ± .3
Pelvic area (cm^2)[bc]	154.7 ± 6.3	203.9 ± 7.1	186.5 ± 6.8	202.1 ± 8.2

[a]From Chase *et al.*, 1997. [b]Angus and Romosinuano (*Bos taurus*) bulls vs Brahman and Nellore X Brahman (*Bos indicus*) bulls ($P < .05$). [c]Angus (temperate breed) bulls vs Brahman, Romosinuano and Nellore X Brahman (tropical breeds) bulls ($P < .05$). [d]Brahman bulls vs Romosinuano bulls ($P < .05$).

In summary, significant breed x age interactions were observed postweaning for body and testicular growth traits. This indicates that patterns of growth differed among the breeds. The delayed growth in scrotal circumference often associated with *Bos indicus* breeds which was also observed in this study is probably not associated with tropical adaptation per se because growth in scrotal circumference was similar between Angus (temperate) and Romosinuano (tropical) bulls. Libido scores were highest for Angus, lowest for *Bos indicus (*Brahman and Nellore x Brahman) and intermediate for Romosinuano bulls. *Bos indicus* bulls were older and heavier at puberty than *Bos taurus* bulls, and Brahman bulls were older and heavier at puberty than Romosinuano bulls. These results suggest that the reproductive traits of Romosinuano and Angus, both *Bos taurus* breeds, are similar, and that the combination of early puberty and tropical adaptation observed in the Romosinuano may be beneficial in warm climates.

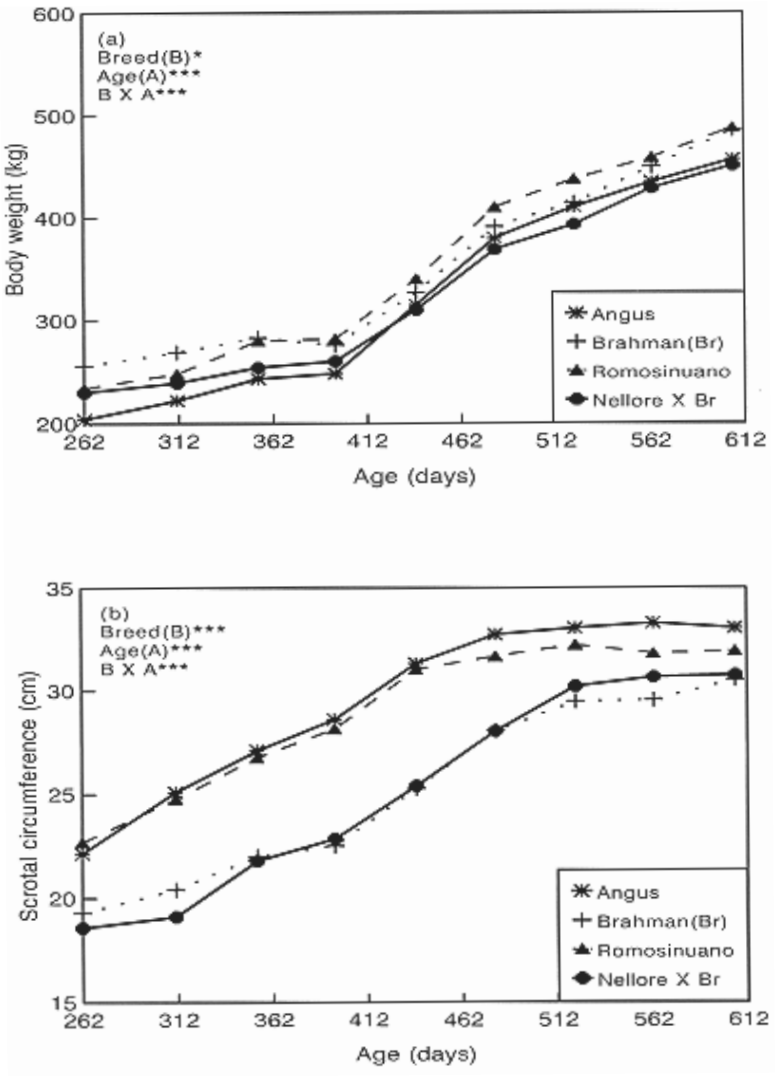

Figure 7.1. Body weight (a) and scrotal circumference (b) of Angus, Brahman, Romosinuano and Nellore x Brahman bulls from weaning through 20 months of age. *P < .05. **P < .001. From Chase *et al.*, 1997.

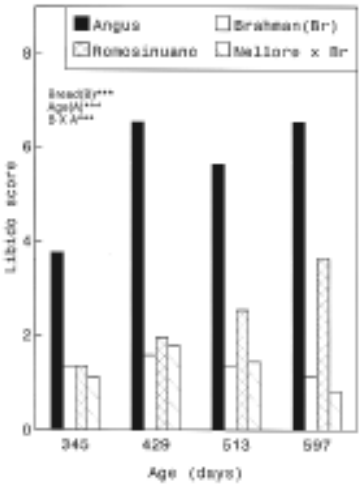

Figure 7.2. Mean libido score on two consecutive days for Angus, Brahman, Romosinuano and Nellore x Brahman bulls on four test periods from about 12 to 20 months of age. ***P < .001. From Chase *et al.*, 1997.

Postweaning growth, heat tolerance, and age and body weight at puberty in heifers

Age and body weight at puberty were determined for 21 Romosinuano heifers born in 1991 and 9 Romosinuano heifers born in 1993 along with a number of other breeds of heifers raised at STARS (table 7.5). After weaning in fall, heifers born in 1991 were stratified among two replicated winter treatments that were either .9 kg / day of soybean meal or 2.3 kg / day of a 75% corn and 25% soybean meal mixture. All heifers had access to bahiagrass hay fed free choice. These winter treatments were fed until spring when forage availability was adequate. In spring of 1992, heifers were assigned to summer grazing treatments that were continuous or rotational grazing of bahiagrass pasture. The replicated winter treatments for heifers born in 1993, were 2.3 kg / day of a 70% soybean hulls and 30% soybean meal mixture or 2.3 kg / day of a 75% wheat middlings and 25% soybean meal mixture. Additionally, all heifers were fed 1.8 kg / day of molasses and bahiagrass hay offered free choice. In spring of 1994, heifers were combined into one group and grazed bahiagrass pastures in early summer and rhizoma perennial peanut (*Arachais glabrata*) - grass pastures in late summer. After weaning and throughout the study, fertile Angus bulls were maintained with the heifers. Age at puberty, was defined as age at first conception resulting in a calf and was calculated from date of calving minus 284 days for gestation.

Table 7.5. Postweaning weight gain (ADG) and age and weight at puberty among breeds of heifers born in 1991 and 1993.

			ADG, kg		Puberty	
Year	Breed	No.	Winter	Summer	Age, months	Body wt., kg
1991	Angus	39	0.38 ± .010	0.26 ± .015	16.2 ± .57	282 ± 5.5
	Brahman (B)	10	0.26 ± .018	0.43 ± .026	25.1 ± 1.16	366 ± 11.1
	Hereford (H)	10	0.40 ± .018	0.37 ± .030	18.8 ± 1.13	313 ± 10.9
	Romosinuano	21	0.35 ± .014	0.39 ± .021	19.0 ± .78	301 ± 7.5
	Senepol (S)	15	0.28 ± .017	0.42 ± .026	17.8 ± .93	326 ± 8.9
	Nellore x B	11	0.26 ± .019	0.40 ± .029	24.3 ± 1.12	336 ± 10.8
	H x S	6	0.35 ± .030	0.40 ± .050	15.2 ± 1.55	311 ± 14.9
	S x H	5	0.31 ± .030	0.53 ± .050	15.6 ± 1.63	298 ± 15.7
1993	Brahman (B)	35	0.42 ± .012	0.45 ± .017	20.4 ± .41	368 ± 6.8
	Romosinuano	9	0.42 ± .027	0.40 ± .045	14.6 ± .81	272 ± 13.6
	Senepol (S)	21	0.43 ± .017	0.50 ± .025	16.3 ± .53	349 ± 8.8
	B x Angus (A)	19	0.59 ± .018	0.55 ± .023	15.9 ± .55	344 ± 9.3
	S x A	19	0.56 ± .018	0.55 ± .023	15.9 ± .55	329 ± 9.3
	Tuli x A	21	0.53 ± .017	0.48 ± .024	15.8 ± .53	306 ± 8.8

Average daily gain during winter for Romosinuano heifers born in 1991 was greater ($P < .05$) than Brahman heifers, but less ($P < .05$) than Angus and Hereford heifers (temperate *Bos taurus* breeds; table 7.5). In summer, average daily gain of Romosinuano heifers was greater ($P < .05$) than Angus and Hereford heifers, and similar to Brahman heifers. To investigate heat tolerance, rectal temperature and respiration rates were measured on heifers during the summer of 1992 (Hammond *et al.*, 1996b). Under hot summer conditions, rectal temperature was greater ($P < .05$) and respiration rates faster ($P < .05$) in Angus than in Brahman, Romosinuano, or Senepol heifers (table 7.6). These data confirm the heat tolerance associated with the adapted tropical breeds and also support the greater average daily gains observed during summer for the tropical breeds compared to the temperate breeds. Age and body weight at puberty for Romosinuano heifers born in 1991 was 19.0 months and 301 kg, respectively (table 7.5). Age and body weight at puberty did not differ between Romosinuano heifers compared to Angus and Hereford heifers, but Romosinuano heifers reached puberty at a younger ($P < .05$) age and lighter ($P < .05$) body weight than Brahman heifers. When the levels of winter nutrition were increased for heifers born in 1993, Romosinuano heifers had similar average daily gains during winter and summer as Brahman, and reached puberty at a younger ($P < .01$) age and lighter ($P < .01$) body weight than Brahman (table 7.5). Age

and body weight at puberty were 14.6 months and 272 kg, respectively, in well-fed Romosinuano heifers born in 1993. These results on puberty in heifers support those observed in their half-sib brothers, and further demonstrate the potential of the Romosinuano to offer, in addition to heat tolerance, improved reproductive traits, particularly, earlier age at puberty, than Brahman.

Table 7.6. Effects of breed on variables related to heat tolerance in heifers[a].

	Breed			
Variable	Angus	Brahman	Romosinuano	Senepol
No. of heifers	43	28	23	16
Rectal temp., ±C[b]	40.4	39.6	39.5	39.2
Log rectal temp.[c]	0.54 ± .008	0.41 ± .010	0.40 ± .011	0.34 ± .013
Resp. rate.[d]	69 ± 1.9	36 ± 2.4	55 ± 2.6	57 ± 3.1

[a]From Hammond *et al.*, 1996b. [b]Derived from a separate analysis of untransformed data. [c]Log (rectal temperature - 37.0). [d]Breaths (respirations) per minute.

Introduction of purebred Romosinuano germplasm of colombian origin into the U.S.A.

In order to objectively evaluate the Romosinuano breed, we recognized the importance of sampling pure Romosinuano germplasm of Colombian origin. Because Costa Rica is recognized as free of foot and mouth disease, prior Romosinuano embryo importations were not restricted by health and sanitary regulations pertaining to foot and mouth disease. In 1991, the U.S. Animal Plant Health Inspection Service (APHIS, 1991) published regulations that allowed the importation of washed embryos into the U.S. from countries with endemic foot and mouth disease and rinderpest. Working under these regulations, in cooperation with the Central University of Venezuela - Maracay and Romosinuano producers in Venezuela, we collected Romosinuano embryos in CENARIA, Venezuela in 1995. Forty-four donor cows and 14 bulls were quarantined and used. Semen was collected and cryopreserved from the bulls to inseminate the donor cows. Estrous was synchronized in donor cows using progestogen (Syncro-Mate-B), and superovulation was induced using follicle stimulating hormone. Embryos were collected by uterine flush using nonsurgical procedures. A total of 143 embryos from 23 cows bred to 13 bulls were collected and cryopreserved. Following all health testing conducted by APHIS, 140 embryos from 22 cows bred to 12 bulls were imported to STARS in February, 1996 (Chase, 1996). To our knowledge, this was the first importation of embryos to the U.S.A. from a country with endemic foot and mouth disease.

As with our prior studies, we were interested in breed of recipient dam effects on pregnancy and preweaning performance of Romosinuano embryo transfer calves. Angus and Senepol cows were used as recipient dams. Estrous was synchronized in recipient dams using progestogen (Syncro-Mate-B) and embryos were transferred 7 days after estrus. Breed of recipient dam did not affect the percentage of cows in estrus after synchronization, or the percentage of recipient dams pregnant after embryo transfer (table 7.7). A total of 70 pregnancies resulted from the transfer of 140 embryos (50% pregnancy). At the time of this writing, 52 of the expected 70 Romosinuano embryo transfer calves have been born. Preliminary results of the 52 calvings, indicated that Romosinuano calves from Senepol recipient dams had a 3-day longer ($P < .05$) length of gestation and 2.2 kg heavier ($P < .05$) birth weight than Romosinuano calves from Angus recipients (table 7.7). Hammond *et al.* (1996a) summarized the partial pedigrees of the 70 pregnancies. The Colombian origin of the pregnancies is evident by the identification of their sires and paternal grandsires (table 7.8), and maternal grandsires (table 7.9).

Table 7.7. Effect of breed of recipient dam on estrus, and pregnancy after transfer of Romosinuano embryos, and preliminary results from 52 calvings.

	Breed of recipient dam	
Item	Angus	Senepol
No. of cows	88	120
No. in estrus	75	101
Synchronized, %	85	84
No. of recipients	67	73
No. pregnant	33	37
Pregnancy, %	49	51
No. of cows calving[a]	27	25
Length of gestation,[*] days	288 ± .9	291 ± .9
Birth weight,[*] kg	32.0 ± .52	34.2 ± .54

[a]Preliminary results from 52 of an expected 70 calvings. [*]$P < .05$.

Table 7.8. Partial pedigree (sire and paternal grandsire) of Romosinuano embryos imported into the U.S.A. that have resulted in pregnancies in recipient dams at STARS[a].

No. of pregnancies	Sire	Paternal grandsire
11	JCT[b] Pate Palo	JHC[c] Pascual
4	GOCA[d] 3004	JHC Pascual
2	ALO[e] Catire 251	ICA[f] Che Guevara
4	ALO Ciseron 254	ICA Che Guevara
8	ICA Turipana Lutero	ICA Turipana 840607
19	ICA Turipana Neron	ICA Turipana 84027
4	ICA Turipana Cirano	ICA Turipana Barrilete
6	GOCA Don Tuilo	TAP[g] Bambuco
1	TAP Bambuco	JHC Chiripas
8	GOCA 3002	ICA Caligula
2	GOCA 3012	GOCA Romito
1	GOCA 3014	ICA Benemonte

[a]From Hammond *et al.*, 1996a. [b]Julio Cesar Torres, Colombia. [c]Jaramillo H. & CIA, Colombia. [d]Ganaderia Otopun, C.A., Venezuela. [e]Agropecuaria Los Olivos, Venezuela. [f]Instituto Colombiano Agropecuario, Colombia. [g]Tulio Albarracin Pedraza, Colombia.

Table 7.9. Maternal grandsire of Romosinuano embryos imported into the U.S.A. that have resulted in pregnancies in recipient dams at STARS[a].

No. of pregnancies	Maternal Grandsire
7	AER[b] El Rosario Guarapo
8	AER Genaro
10	AER Campeon
3	ICA[c] Campeon
4	ICA Pablo
3	JCT[d] San Luis Achote
1	JCT San Luis Capotero
9	JCT San Luis El Viento
2	JCT San Luis Cesar
1	JAM[e] Fidel
2	JHC[f] Chiripas
5	JHC Laurel
2	JHC Juancho
7	JHC Lucas
6	TAP[g] Paviyay Emperador

[a]From Hammond *et al.*, 1996a. [b]Colombia. [c]Instituto Colombiano Agropecuario, Colombia. [d]Julio Cesar Torres, Colombia. [e]Colombia. [f]Jaramillo H. & CIA, Colombia. [g]Tulio Albarracin Pedraza, Colombia.

The Romosinuano embryo transfer calves of Colombian origin (currently 24 heifers and 28 bulls) will be added to the Costa Rican Romosinuano herd at STARS. The current inventory of Costa Rican Romosinuano at STARS includes 34 mature cows (29 with calves), 4 mature bulls, 8 two-yr-old heifers, 14 yearling heifers, and 9 yearling bulls.

Other Romosinuano research in the U.S.A.

At the University of Missouri, two environmental chamber studies to assess heat tolerance were conducted with six Angus, four Romosinuano, and two Romosinuano x Angus calves (Spiers *et al.*, 1994). Results confirmed the heat tolerance of the Romosinuano and its dominance in F1 progeny when compared to Angus. After the completion of these studies, two of the Romosinuanos (one bull and one heifer) were sent to STARS to be included in the Costa Rican Romosinuano herd. Another study also conducted at the University of Missouri, evaluated carcass characteristics between 18 Angus and 16 Romosinuano x Angus steers and heifers (Clarke *et al.*, 1993). Tenderness was similar between the breed groups and USDA quality grade was similar or better in the crossbreds. Tenderness, particularly consistency and predictability of tenderness, is currently of great concern to the beef cattle industry in the U.S.A. Collectively, these results confirm the heat tolerance of Romosinuano, a tropically adapted *Bos taurus* breed, and suggest that in addition to heat tolerance this breed may offer acceptable tenderness and carcass quality for the U.S.A. market.

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